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F. AIR QUALITY

SETTING

CLIMATE

Summer weather in the vicinity of the Project Area is dry, with mild temperatures and a lower incidence of fog than is found in most other parts of San Francisco. Winters are cool and moist. The predominant wind pattern is northwesterly and westerly winds from the Pacific Ocean. The marine layer typically extends from the ground surface to an elevation of 2,000 feet./1,2/ When the elevation of the marine layer is lower, ocean breezes enter San Francisco through the Golden Gate gap./3/ These maritime influences moderate summer and winter temperatures and, in general, reduce the air pollution potential in San Francisco.

Inversions occur occasionally over the Bay Area, reducing vertical dispersion of pollutants./4/ In the absence of winds to transport pollutants away from emission sources, inversions increase air pollution potential. Subsidence inversions in summer and fall limit vertical dispersion, often for extended periods and, together with strong sunlight, produce worst-case conditions for ozone generation. Surface inversions, characteristic of wintertime, radiational cooling at land surfaces, are generally of short duration, but they begin at or near the earth's surface, so emissions can accumulate near ground level. In general, the potential for air pollution problems in the Project Area is greatest during fall and winter, when winds are light and inversion heights are low, such as 1,500 feet.

AIR QUALITY

Air Quality Regulations and Standards

Federal and state air quality standards have been established for five major ambient air pollutants, primarily to protect human health and welfare. These pollutants are ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulates (PM_{10}) (see Appendix F, Table XIV.F.1, p. XIV.F.1). Documented health effects from air pollution include acute respiratory infections, chronic bronchitis, chronic constrictive ventilatory disease, pulmonary emphysema, and bronchial asthma. For environmental impact analyses, estimated potential pollutant concentrations associated with a proposed project are compared with the most stringent federal or state standard./5/

Federal 1977 Clean Air Act Amendments, under the jurisdiction of the U.S. Environmental Protection Agency (EPA), require each state to identify areas within its borders that do not meet federal ambient air quality standards (termed "non-attainment areas"). The EPA has designated the San Francisco Bay Area Air Basin, which includes the Project Area, as a non-attainment area for O_3 and CO.

The EPA also has required each state to submit a State Implementation Plan (SIP), specifying strategies which will be used to attain federal ambient air quality standards by 1987. The California Air Resources Board (ARB) is the state agency responsible for submitting the SIP to the EPA.

The ARB classifies air basins or portions thereof as "attainment" or "non-attainment" with respect to the federal standards, based on air quality monitoring data collected by the ARB and regional Air Quality Management Districts. It establishes state ambient air quality standards and state emission standards for new vehicles that, in many cases, are more stringent than federal standards. In California, the more stringent of the federal and state standards applies; however, current air quality planning activities are focused on attaining federal ambient air quality standards.

The Bay Area Air Quality Management District (BAAQMD) has primary responsibility for the attainment and maintenance of air quality standards in the San Francisco Bay Area Air Basin./6/ It operates a network of community air quality monitoring stations that measure and record ambient (background) levels of O_3, CO, NO_2, SO_2, total suspended particulates (TSP), and PM_{10}. The closest air quality monitoring station is on Arkansas Street (near 16th Street), less than one mile from the Project Area. This station has been in operation since 1986./7/ A five-year summary (1982-1986) of air quality monitoring data collected for San Francisco is presented in Appendix F, Table XIV.F.2, p. XIV.F.2. The BAAQMD also operates a micro-scale monitoring station on Ellis Street between Franklin Street and Van Ness Avenue.

In 1982, the Association of Bay Area Governments (ABAG), BAAQMD and the Metropolitan Transportation Commission (MTC) developed the 1982 Bay Area Air Quality Plan for incorporation into the SIP./8,9/ The 1982 Plan set forth a time schedule for attainment of federal air quality standards for O_3 and CO by 1987. The 1987 deadline for attainment of the federal air quality standards has passed and the Bay Area remains in non-attainment of the federal O_3 and eight-hour average CO standards. Congress is considering additional amendments to the Clean Air Act to address those areas of the country that remain in non-attainment.

Regional and San Francisco Air Quality

Because it is located in a non-attainment area for O_3 and CO, mobile- and stationary-source emissions from the Project Area should be consistent with regional air quality objectives, particularly with attainment strategies for O_3 and CO described in the 1982 Plan. A description of the five major pollutants for which ambient air quality standards exist is presented below.

Ozone (O_3)

The most severe air quality problem in the San Francisco Bay region is O_3. O_3 is not emitted directly into the atmosphere, but is produced in the atmosphere through a complex series of photochemical reactions involving hydrocarbons (HC) and nitrogen oxides (NO_x), precursors of O_3, that are emitted primarily from motor vehicles, and residential and industrial fuel combustion processes. High levels of O_3 typically occur in the summer and autumn on warm, windless, sunny days with inversion heights of 1,500 feet or less.

Within the region, O_3 standards are violated most often in the Santa Clara, Livermore, and Diablo Valleys because local topography and meteorological conditions favor the build-up of O_3 and its precursors in those locales. Despite the more favorable meteorological and topographical conditions in San Francisco, high levels of O_3 occasionally occur. The state O_3 standard was last violated in San Francisco in the early afternoon in September 1983. Predominant winds push NO_x and HC emissions from San Francisco sources to the East Bay and South Bay, where they contribute to regional O_3 formation. High levels of ambient O_3 can cause eye, nose, and throat irritation; chest constriction; or severe coughing. Children and individuals with chronic lung disease typically are the most sensitive population groups to high ambient levels of O_3.

The 1982 Plan recommended that the most efficient way to reduce O_3 levels is to reduce HC emissions. The 1982 Plan projected that a reduction in HC emissions of 85 tons per day would result in attainment of the federal O_3 standard by 1987; however, region-wide attainment was not achieved by the end of 1987 as required by the Clean Air Act. The

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major contributing factor that prevented achievement of the federal O_3 standard was the simultaneous reduction of HC and NO_x. Given the ratio of HC to NO_x typical in the Bay Area, reduction of NO_x can actually increase O_3 levels, offsetting the benefit of reduced HC emissions. (Different HC to NO_x ratios show different sensitivities.) Other contributing factors were that the Inspection / Maintenance Program has not been as effective in reducing motor vehicle HC emissions as expected, and implementation of five of the 23 stationary source control measures outlined in the Plan was delayed.

O_3 levels can fluctuate widely from year to year because of their sensitivity to variations in weather. However, the overall trend for O_3 concentration levels in the region was downward in the 20 years prior to 1984./10/ Regional inventories by the BAAQMD project that HC emissions will begin to rise in 1990 after a 25-year period of decreasing emissions, which could prevent the Bay Area from ever attaining the federal O_3 standard.

Carbon Monoxide (CO)

CO is a non-reactive pollutant whose major source is motor vehicles. Persons with cardiorespiratory disease or anemia may be particularly susceptible to adverse effects from high ambient CO levels. These effects include impaired psychomotor abilities, impaired visual acuity, headaches, fatigue, drowsiness, and respiratory failure. CO emission levels have declined substantially over the last 25 years./11/ Regional emission inventories developed by the BAAQMD projected that this trend would end by 1987, and that thereafter, CO emissions would stay relatively constant until 2000.

Concentrations of CO generally occur in localized areas, or hot spots, such as congested intersections with comparatively high traffic volumes. Highest concentrations of CO typically occur on cold, windless nights from November through February (more than 80% of ambient standard violations in the Bay Area occur between November and January and 90% of these violations occur between 4:00 p.m. and 2:00 a.m.). Between 1982 and 1986, the eight-hour federal and state CO standard of nine parts per million (ppm) was violated once at the monitoring station in San Francisco nearest to Mission Bay (Potrero Hill). The maximum value was 9.1 ppm, recorded in October 1982 between 5:00 p.m. and 1:00 a.m.

The 1982 Bay Area Air Quality Plan recommended a CO control strategy for three specific areas -- San Jose, Oakland and Vallejo -- where the federal and state eight-hour standard most often had been violated. The 1982 Plan projected that, with existing vehicle emission control programs, the remaining portions of the Bay Area, including San Francisco, would not experience CO violations.

Hot-Spot Monitoring. CO is known as a localized air pollutant, with the highest levels in proximity to heavily traveled roads and intersections. In general, permanent BAAQMD stations are not located near major intersections, so CO monitoring data from these stations are more representative of ambient, or background, CO levels.

To determine local CO conditions, the BAAQMD conducted two hot-spot monitoring programs at heavily traveled locations in several parts of the Bay Area, including San Francisco County./12,13/ In San Francisco, one of the hot-spot locations where CO levels were monitored by the BAAQMD during the winter of 1979-80 was the intersection of Washington and Battery Streets. The high eight-hour average concentration was 10.1 ppm, which violates the state and federal standards by 1.1 ppm. The high one-hour average concentration of 15 ppm does not violate the 20-ppm state standard or the 35-ppm federal standard.

Another CO monitoring program was conducted during the winter of 1980-81 at the intersection of Geary and Taylor Streets, and at 100 Harrison Street at Spear Street. At Geary and Taylor, the observed high eight-hour average concentration was 11.5 ppm, which violates the standards by 2.5 ppm, and the high one-hour concentration was 15 ppm, which does not violate standards. At Harrison Street, the observed high eight-hour and one-hour average concentrations were 7.8 ppm and 13 ppm, respectively, which do not violate standards.

In December 1985, hot-spot CO monitoring was conducted for this EIR at the intersection of Sixth and Brannan Streets. The purpose of the monitoring was to measure peak CO concentrations at Sixth and Brannan Streets, and to compare these concentrations with traffic counts at the intersection and with monitoring data from BAAQMD's Potrero Hill station, approximately 1.5 miles south-southeast of the Sixth and Brannan Streets intersection. That intersection was selected for hot-spot CO monitoring because it currently experiences the highest traffic volumes of all identified critical intersections for the proposed project./14,15/ There were no violations of CO standards.

Total Suspended Particulate (TSP) and Respirable Particulate (PM_{10})

The most important sources of total suspended particulate (TSP) in San Francisco are fugitive emissions (dust) from demolition and construction activities, and from motor vehicles traveling over paved roads. BAAQMD regional projections indicate that TSP emissions would increase by about 33% between 1982 and 2000, following a downward trend for the 25-year period prior to 1982./11/

State standards for particulate matter changed in 1983 and federal standards changed in 1987 to concentrate on fine particulate matter (PM_{10}) which has been demonstrated to have health implications when inhaled. Correlations have been observed between increases in PM_{10} concentrations and the incidence of upper respiratory infections, cardiac diseases, bronchitis, asthma, pneumonia, and emphysema. Actual monitoring for PM_{10} did not begin in San Francisco until April 1986, so only particulate data collected under the previous TSP standards are considered in this EIR.

The federal standard of 150 ug/m^3 of TSP for a 24-hour average has been replaced by a standard of 150 ug/m^3 of PM_{10} for a 24-hour period and 50 ug/m^3 annual average. The former standard, in effect until 1987, was violated occasionally in various locations in the Bay Area, including San Francisco. The BAAQMD's Potrero Hill monitoring station recorded maximum 24-hour average TSP concentrations of 152 ug/m^3 in 1984, 158 ug/m^3 in 1985, and 124 ug/m^3 in 1986.

A portion of the suspended particulates in the air is lead; the state and federal governments both have established a separate standard for lead (see Appendix F., Table XIV.F.1, p. XIV.F.1). Motor vehicles using leaded fuels are the major source of lead emissions in the Bay Area, accounting for 98% of the ambient lead. Since 1978, lead levels have decreased due to the phasing-out of motor vehicles using leaded fuel. No violations of the state or federal lead standards have been recorded in San Francisco since 1978, and none are anticipated in the future. Because of the negligible potential for adverse impacts on future air quality from ambient lead concentrations, lead will not be discussed further in this analysis.

Nitrogen Oxides (NO_x)

Nitrogen oxides (NO_x), which consist of nitric oxide (NO) and nitrogen dioxide (NO_2), contribute to the formation of O_3. NO is released by stationary and mobile sources and tends to oxidize in the air to NO_2. NO_2 is highly reactive in the presence of sunlight, and combines with reactive hydrocarbons to form photochemical smog, of which the major constituent is O_3. NO_2 acts as an irritant and has been correlated with respiratory diseases in sensitive population groups.

The major sources of NO_x in the San Francisco Bay region are vehicular, residential and industrial fuel combustion. Emissions of NO_x have decreased in the Bay Area since 1978 because of a drop in fuel consumption, vehicle emission control programs, and lower emission rates for diesel construction equipment and fuel combustion categories./11/ Federal and state standards for NO_2 have not been violated in the Bay Area since 1980. NO_x emissions were projected by the BAAQMD to stay constant until 1990, and then to follow a rising trend -- increasing about 15% between 1990 and 2000./8/

Sulfur Dioxide (SO_2)

The major sources of sulfur dioxide (SO_2) emissions in the Bay Area are petroleum refining and combustion of diesel fuels by ships, trucks, and buses.

According to BAAQMD emission inventories, regional SO_2 emissions followed a decreasing trend from 1974 until 1982, when they began to rise. While the maximum 24-hour SO_2 concentrations measured in San Francisco increased from 1982 to 1985 -- 0.012 ppm in 1981 to 0.028 ppm in 1986 - state and federal standards (0.05 ppm and 0.14 ppm, respectively) have not been violated in over a decade. The reasons for that rise in SO_2 readings have not been identified./16/

Regional SO_2 emissions are projected by the BAAQMD to double in the period between 1987 and 2000 due, in part, to a projected switch from natural gas to oil for generation of electricity.

Project Area Emissions

The Mission Bay Project Area contributed about 15,900 trips per day to regional vehicle travel in 1985, constituting less than 3% of San Francisco County emissions./17/ Emissions of HC, NO_x, CO, TSP, and SO_2 are estimated based on the information contained in Appendix F., Table XIV.F.3, p. XIV.F.3, and compared with county-wide emission levels, as shown in Table VI.F.1. Emissions from industrial sources in the Project Area and vicinity are identified in Appendix F, Table XIV.F.3, p. XIV.F.3. Major

TABLE VI.F.1: PROJECT AREA AND COUNTY EMISSIONS, 1985 (Tons per Day)

Pollutant	Emissions Mission Bay/a/	Emissions 1985 San Francisco/b/	Mission Bay Contribution to County Emissions (%)
Carbon monoxide	6.70	230	2.90%
Hydrocarbons	0.44	53	0.83%
Nitrogen oxides	0.47	40	1.20%
Sulfur dioxide	0.040	13	0.31%
Total suspended particulate /c/	0.46	71	0.65%

/a/ Traffic emissions only; building emissions are assumed to be negligible. Assumes an average speed of 25 miles per hour and composite vehicle emission factors from BAAQMD, Air Quality and Urban Development Guidelines for Assessing Impacts of Projects and Plans, November 1985. These composite vehicle emission factors were revised in April 1988 to reflect EMFAC7D emission factors developed by California Air Resources Board.

/b/ San Francisco County emissions for 1985 were estimated using BAAQMD emission inventories contained in Emissions Inventory Summary Report, August 1987.

/c/ Includes dust disturbed from roads.

SOURCE: Baseline Environmental Consulting, Inc. and Environmental Science Associates, Inc.

sources in the Project Area include a train terminal, private bus yards, a coffee-roasting firm, and two concrete plants where concrete is produced from cement and aggregate for packaging or transport. Ship repair firms adjacent to the Project Area on the east are also major industrial sources.

Commercial and industrial activities in the Project Area and vicinity generate emissions of NO_x and CO from combustion of natural gas for space-heating and industrial processes (such as boilers). Emissions from industrial processes are negligible compared to motor vehicle emissions./18/ Space-heating emissions for the downtown San Francisco area were estimated to contribute less than 3% of total emissions from the area./19/ Existing land uses in the Project Area would, by comparison, generate negligible NO_x and CO emissions from space heating.

PG&E's oil-fired power plants generate electricity for use in existing buildings in the Project Area and for electrically-powered public transit systems serving the Project Area, emitting criteria pollutants (SO_2, NO_2, TSP, CO, and HC, in decreasing order by weight). Some of those plants are located within the Bay Area Air Basin, in San Francisco, Solano and Contra Costa Counties. Emissions from the plants related to consumption of electricity in the Project Area contribute to current air quality violations in the Air Basin.

Project Area Carbon Monoxide Levels

Eight intersections in the project vicinity, listed in Table VI.F.2, were selected for this analysis because they have the potential to experience high ambient CO concentrations (see Appendix F., Figure XIV.F.1, p. XIV.F.4). These intersections currently experience,

TABLE VI.F.2: WORST-CASE CARBON MONOXIDE CONCENTRATIONS AT SELECTED INTERSECTIONS, 1985 (Parts per Million)

	CO Concentration	
Intersection/a/	Eight-Hour Average/b/	One-Hour Average/c/
1. Second and Bryant Streets	7.9	11.3
2. Fifth and Bryant Streets	8.7	12.4
3. Sixth and Brannan Streets	13.4	19.1
4. First and Harrison Streets	8.1	11.6
5. Third and Berry Streets	9.2	13.1
6. Third and Fourth Streets	8.2	11.7
7. Third and Sixteenth Streets	8.2	11.7
8. Mariposa Street and Pennsylvania Avenue	7.7	11.0

/a/ Intersection locations are shown in Appendix F, Air Quality, Figure XIV.F.1, p. XIV.F.4.

/b/ The concentrations are computed by a modified version of the Modified Linear Rollback Model described in Appendix F, p. XIV.F.5. The concentrations are the sum of a background component, which reflects the ambient concentration levels, and the local component, which reflects vehicular traffic emissions at the intersection. Underlined values are in excess of the applicable standard (9.0 ppm for eight-hour average; 20.0 ppm for one-hour average). ARB-derived emission factors, version EMFAC7D, were used. Concentrations above the applicable standard are underlined.

/c/ One-hour concentration = eight-hour concentration divided by 0.7.

SOURCE: Baseline Environmental Consulting.

or are projected to experience, the most congested traffic conditions in the project vicinity; these conditions are, or would be, generated primarily by travel from the Downtown & Vicinity. The air quality analysis is based on traffic data discussed in VI.E. Transportation, p. VI.E.11-VI.E.13 and worst-case meteorological assumptions for 1985. Calculated CO concentrations exceed the federal and state eight-hour CO standards at the Sixth and Brannan Streets intersection and the Third and Berry Streets intersection. Calculated CO levels did not exceed the one-hour (state) standard at any of these intersections. The methodology used to estimate CO levels at these eight intersections is described in Appendix F., beginning on p. XIV.F.5.

IMPACT

This section identifies the sources of air pollutant emissions associated with the construction and operational phases of the Alternatives. The effects of those emissions on local and regional air quality are then examined to determine the potential for a significant impact, the identification of which would trigger a requirement for adequate measures to mitigate the impact. For the operational phase, effects of the Alternatives on air quality are estimated for the interim analysis year, 2000, and build-out in about 2020. Since county-wide emissions inventories for years beyond 2000 have not yet been developed, effects on regional air quality in 2020 are described on the basis of year 2000 county-wide emissions inventories.

DEMOLITION, EXCAVATION, AND CONSTRUCTION EMISSIONS

During site development under all Alternatives, local air quality would be affected by emissions of NO_x, CO, SO_2, HC, and particulate matter (PM), including fugitive dust. Demolition, excavation, and construction activities would generate fugitive dust. Diesel-powered construction equipment would emit NO_x, CO, SO_2, HC, and PM. Architectural coatings, particularly solvent-based coatings for structural surfaces such as steel beams and wood exterior surfaces, would emit HC. With the exception of fugitive dust, the short-term contribution of pollutant emissions from site development activities would not be significant.

Fugitive Dust

The impact on air quality of fugitive dust generated by construction activities for all Alternatives would depend on the quantity and drift potential of the dust particles emitted. Larger dust particles (for example, over 100 micrometers, or microns, in diameter,) would tend to settle closer to the source than fine particles (less than 10 microns in diameter, PM_{10}). The dispersion distances and patterns would depend on local wind conditions, soil type, and moisture content./20/

Dust generated by demolition, excavation, construction activities, and wind erosion of exposed soil surfaces would contain substantial quantities of PM_{10}. According to the ARB, 64% of particles from road and building construction are PM_{10}./21/ Emissions of dust during site development under all Alternatives are anticipated to result in local PM_{10}

concentrations in violation of state and federal standards and, therefore, would require mitigation.

Toxic Air Contaminants

Fugitive dust generated for all Alternatives during ongoing demolition, excavation, and construction in former industrial and fill areas may contain toxic constituents. Past land uses in the Project Area that may have introduced toxic substances into the surface and subsurface soils, structures, or on-site debris are discussed in VI.N. Hazardous Wastes, beginning on p. VI.N.9. Short-term health impacts could result from inhalation of airborne contaminants, particularly by construction workers. Airborne toxic substances could also result in exposure through skin contact or ingestion of dust. Potential adverse health effects are also discussed on pp. VI.N.32.

Gaseous pollutants may be emitted during construction in former fill areas from disturbance of subsurface soils, and could affect health and safety of construction workers. Gases consisting primarily of methane and carbon dioxide may have been generated by biodegradation of fill materials. Methane is a fire and explosion hazard and an asphyxiant in concentrations greater than 5% of air; carbon dioxide is also an asphyxiant in high concentrations. During construction, gases that are heavier than air may accumulate in excavated trenches and pose hazardous working conditions. The Mitigation Program addresses potential hazards to construction workers and early occupants of the project from such gases.

Odors

Under all Alternatives, odors may be generated during the course of site development in former landfill areas and Bay muds. Localized odors would be detectable around excavation areas, and temporarily would affect primarily construction workers and Project Area occupants. Temporary annoyance would be the only anticipated effect.

BUILDING EMISSIONS

Combustion of natural gas for space-heating would generate primarily emissions of NO_x./20/ Other pollutants generated would include CO, HC, SO_2 and PM_{10} Space-heating emissions of NO_x would constitute less than 10% of total Project-Area emissions (i.e., space-heating and motor vehicle emissions) of NO_x. Space-heating emissions of CO, HC, SO_2, and PM_{10} would be much less than 10% of total Project-Area emissions of these pollutants. Thus, space-heating emissions should be negligible compared to motor vehicle emissions and will not be considered further in this analysis.

MOTOR VEHICLE EMISSIONS

Vehicular traffic from the Project Area would emit HC, NO_x CO, SO_2, and PM_{10}. The net increase in vehicular emissions associated with development in the Project Area has been estimated and is summarized in Table VI.F.3 for each Alternative for the years 2000 and 2020. These estimates consist of just the emissions from vehicle miles traveled within San Francisco County. Existing vehicular emissions released within San Francisco County have been subtracted from total Project Area emissions to show the project increment for each Alternative.

This net increase in emissions for the Project Area by 2000 is compared with San Francisco County transportation-related emissions for 2000. Project Area emissions in 2020 are also compared with year 2000 San Francisco County emissions. Emissions inventories beyond 2000 are not available./22/ Motor vehicle emissions would affect air quality at both the regional and the local level. Emissions would contribute to ambient concentrations of pollutants which could occasionally violate air quality standards. The primary air quality concern at the regional level would be the Project Area's contribution to regional ozone concentrations. The primary air quality concern at the local level would be the Project Area's contribution to ambient CO concentrations at congested urban intersections in its vicinity.

The human health effects from emissions under all Alternatives cannot be identified based on emissions projections. Human health effects from an air pollutant are a function of the physical condition of those exposed and the ambient concentration, which in turn depends on source emission rates (the project is only one source) and local meteorology, to name a few factors. The primary method of determining the effect of air pollution on human health has been to monitor ambient air concentrations of the five criteria pollutants and to compare these monitored concentrations with federal air quality standards established to protect human health. It is not possible to identify precisely the health effects resulting from Mission Bay-related emissions, although compliance with the standards implies that there would be no substantial health risk for the general public.

TABLE VI.F.3: NET INCREASE IN VEHICULAR EMISSIONS WITHIN SAN FRANCISCO COUNTY FOR THE PROJECT AREA, BY ALTERNATIVE, 2000 AND BUILD-OUT/2020 (Tons Per Day)/a/

	2000						2020					
	Alternative A		Alternative B		Alternative N		Alternative A		Alternative B		Alternative N	
Pollutant	Emissions (tpd)	% of County/b/	Emissions (tpd)	% of County/b/	Emissions (tpd)	% of County/b/	Emissions (tpd)	% of County/b/	Emissions (tpd)	% of County/b/	Emissions (tpd)	% of County/b/
CO	5.6	3.6%	1.8	1.2%	2.3	1.5%	15.0	9.6%	8.5	5.4%	9.6	6.2%
HC	0.17	0.74%	0.0	0.0%	0.02	0.09%	0.57	2.5%	0.30	1.3%	0.33	1.4%
NO_x	0.29	1.5%	0.08	0.4%	0.10	0.50%	0.85	4.3%	0.46	2.3%	0.53	2.7%
SO_2	0.05	0.33%	0.02	0.13%	0.02	0.13%	0.13	0.87%	0.07	0.47%	0.08	0.53%
PM_{10}/c/	0.27	/d/	0.11	/d/	0.13	/d/	0.78	/d/	0.37	/d/	0.44	/d/

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tpd - tons per day

/a/ Vehicular emissions are based on BAAQMD emission factors derived from ARB EMFAC7D emission factors, an assumed average speed of 15 miles per hour, and an assumed three minutes of idling time per trip. Only vehicle miles traveled within San Francisco County are included in these emissions estimates.

/b/ Percent of transportation-related emissions for San Francisco County are based on the year 2000 regional transportation emissions inventory which was used to adjust the 1983 transportation-related emissions inventory for San Francisco County, contained in BAAQMD Emissions Inventory Summary Report, August 1987.

/c/ The PM_{10} emission factor is assumed to be 1.07 grams per mile. It is based on the assumption that approximately 98% of TSP vehicle emissions and 39% of dust disturbed from paved roads are PM_{10} (0.3 g TSP/mile × 0.975 = 0.29; 2 g disturbed dust/mile × 0.39 = 0.78; 0.29 + 0.78 = 1.07 g PM_{10}/mile) (Source: 1987 ARB Draft Emission Inventory).

/d/ Inventories of PM_{10} emissions have not yet been developed by the BAAQMD.

SOURCE: Baseline Environmental Consulting, Inc. and Environmental Science Associates, Inc.

Regional Air Quality

Bay Area Air Quality Management District (BAAQMD) guidelines set forth significance thresholds for assessing the air quality impacts of project-related emissions./17/ For projects whose emissions are predominantly associated with motor vehicle trips, those guidelines recommend that project emissions be compared with county-wide transportation-related emissions. If a project would generate a net increase in emissions amounting to greater than 1% of county-wide (transportation-related) emissions, then it would be considered to have a significant effect on air quality. A determination of significant effect on air quality on the basis of this 1% threshold criteria does not mean necessarily that a project's emissions would cause, or contribute measurably to, excesses of ambient air quality standards. Rather, the purpose of the 1% criteria is to identify those projects which would cause a substantial change in area-wide emissions. Land use and transportation measures to reduce emissions from such projects should then be seriously considered by local governments. These assessment guidelines and the results of emission calculations shown in Table VI.F.3, p. VI.F.14, will form the basis for the impact discussion that follows. Only those emissions that would occur in San Francisco County have been included in the estimate of net increase.

2000

Alternative A. Emissions associated with motor vehicle traffic generated by land use development in the Project Area under Alternative A would be about 19 tons per day of CO, 0.84 tons per day of HC, 1.1 tons per day at NO_x, 0.16 tons per day of SO_2 and 0.82 tons per day at PM_{10}. As shown in Table VI.F.3, Project Area emissions of CO and NO_x under Alternative A would exceed the 1% threshold of significance. Thus, Alternative A emissions would significantly increase county-wide emissions of those two pollutants, which is a significant effect. Alternative A emissions would be about 80% greater than Alternative B emissions and about 60% greater than Alternative N emissions.

Alternative B. Emissions associated with motor vehicle traffic generated by development in the Project Area under Alternative B would be about 11 tons per day of CO, 0.45 tons per day of HC, 0.65 tons per day of NO_x, 0.09 tons per day of SO_2, and 0.45 tons per day of PM_{10}. As shown in Table VI.F.3, pollutant emissions under Alternative B would exceed the 1% threshold for CO and, thus, would significantly increase county-wide emissions of that pollutant. Unlike Alternative A, motor vehicle emissions of NO_x would not be significant. Alternative B emissions would be about 60% of Alternative A emissions and about 90% of Alternative N emissions.

Alternative N. Emissions associated with motor vehicle traffic generated by development in the Project Area under Alternative N would be about 12 tons per day of CO, 0.51 tons per day of HC, 0.72 tons per day of NO_x, 0.09 tons per day of SO_2, and 0.51 tons per day of PM_{10}. As shown in Table VI.F.3, pollutant emissions of CO would exceed the 1% threshold of significance. Emissions under this Alternative would significantly increase County-wide emissions of CO and would be a significant effect. Unlike Alternative A, emissions of NO_x under this Alternative would not be significant. Alternative N emissions would be about 60% of Alternative A emissions and about 10% greater than Alternative B emissions.

Build-Out/2020

Alternative A. Emissions associated with motor vehicle traffic generated by development in the Project Area under Alternative A would be about 42 tons per day of CO, 1.8 tons per day of HC, 2.4 tons per day of NO_x, 0.34 tons per day of SO_2, and 1.8 tons per day of PM_{10}. As shown in Table VI.F.3, Project Area emissions of CO, HC, and NO_x under Alternative A would greatly exceed the 1% threshold of significance which indicates a significant change in County-wide emissions of these pollutants. Project emissions of CO, HC, and NO_x would be a significant effect under Alternative A in 2020. Alternative A emissions would be about 60% greater than Alternative B emissions and about 40% greater than Alternative N emissions.

Alternative B. Emissions associated with motor vehicle traffic generated by development in the Project Area under Alternative B would be about 25 tons per day of CO, 1.1 tons per day of HC, 1.5 tons per day of NO_x, 0.20 tons per day of SO_2, and 1.1 tons per day of PM_{10}. As shown in Table VI.F.3, Project Area emissions of CO, HC, and NO_x under Alternative B would greatly exceed the 1% threshold of significance which indicates a significant change in County-wide emissions of these pollutants. Project emissions of CO, HC, and NO_x would be a significant effect under Alternative B by 2020. Alternative B emissions would be about 60% of Alternative A emissions and about 80% of Alternative N emissions.

Alternative N. Emissions associated with motor vehicle traffic generated by development in the Project Area under Alternative N would be about 30 tons per day of CO, 1.3 tons per day of HC, 1.8 tons per day of NO_x, 0.24 tons per day of SO_2, and 1.3 tons per day of PM_{10}. As shown in Table VI.F.3, Project Area emissions of CO, HC, and NO_x under Alternative N would greatly exceed the 1% threshold of significance which indicates a significant change in County-wide emissions of these pollutants. Project emissions of CO, HC, and NO_x would be a significant effect under Alternative N by 2020. Alternative N emissions would be about 70% of Alternative A emissions and about 20% greater than Alternative B emissions.

Local Air Quality

For each of the Alternatives, Project Area-related vehicular emissions of CO are estimated for eight selected intersections using methodology described in Appendix F, beginning on p. XIV.F.5. Estimated CO concentrations are presented in Table VI.F.4. CO concentrations generally would be expected to improve throughout the region due primarily to the continuing introduction into the vehicle fleet of new vehicles equipped with better emission controls. There would be no violations of federal or state standards at the selected intersections.

However, the CO level estimates shown in Table VI.F.4 are based on traffic estimates that assume a modal shift from autos to transit by workers in the Downtown & Vicinity. If a shift of the degree assumed for this report did not occur, the result would be a lengthening of the peak period with a corresponding adverse effect on eight-hour average CO levels, especially near freeways and freeway ramps.

2000

Alternative A. CO concentrations at critical intersections in the vicinity of the Project Area would decrease from 1985 levels. No excesses of the state or federal ambient CO concentrations are anticipated. The intersection of Sixth and Brannan Streets would continue to experience the highest CO concentrations of the eight intersections analyzed. Estimated future CO concentrations reflect cumulative traffic conditions projected for the vicinity. The selected intersections currently operate at capacity, and would continue to do so in the future. Additional traffic generated by any of the Alternatives would not further impair traffic flow patterns at those intersections in a measurable way.

Alternative B. CO concentrations in 2000 at the selected intersections analyzed would be comparable to those identified for Alternative A.

TABLE VI.F.4: ESTIMATED WORST-CASE CARBON MONOXIDE CONCENTRATIONS AT SELECTED INTERSECTIONS, BY ALTERNATIVE, 1985, 2000, AND BUILD-OUT/2020/a/ (Parts per Million)

		CO Concentration by Alternative (ppm)						
		1985	2000			2020		
			Alternative			Alternative		
Intersection	Averaging Period		A	B	N	A	B	N
1. Second/Bryant Streets	8-hr.	7.9	5.5	5.5	5.5	5.5	5.5	5.5
	1-hr.	11.3	7.8	7.8	7.8	7.9	7.9	7.9
2. Fifth/Bryant Streets	8-hr.	8.7	5.9	5.9	5.9	5.9	5.9	5.9
	1-hr.	12.4	8.4	8.4	8.4	8.5	8.5	8.4
3. Sixth/Brannan Streets	8-hr.	13.4	6.9	6.9	7.0	7.0	7.0	7.1
	1-hr.	19.1	9.9	9.9	10.0	10.0	10.0	10.1
4. First/Harrison Streets	8-hr.	8.1	5.6	5.6	5.6	5.6	5.6	5.6
	1-hr.	11.6	7.9	7.9	7.9	8.0	8.0	8.0
5. Third/Berry Streets	8-hr.	9.2	5.4	5.4	5.4	5.5	5.5	5.5
	1-hr.	13.1	7.7	7.7	7.7	7.9	7.8	7.8
6. Third/Fourth Streets	8-hr.	8.2	5.5	5.5	5.5	5.6	5.5	5.5
	1-hr.	11.7	7.9	7.8	7.9	7.9	7.9	7.9
7. Third/16th Streets	8-hr.	8.2	5.5	5.5	5.5	5.6	5.5	5.6
	1-hr.	11.7	7.9	7.9	7.9	8.0	7.9	7.9
8. Mariposa Street/ I-280 On-Ramp	8-hr.	7.7	5.4	5.4	5.4	5.4	5.4	5.4
	1-hr.	11.0	7.7	7.7	7.7	7.7	7.7	7.7

/a/ The tabulated concentrations are the sum of a background and a local component. The background component is influenced by the cumulative effects of all vehicular traffic in the project vicinity; and the local component reflects the effects of vehicular traffic at the intersection. A full description of the method for estimating the local CO component is contained in Appendix F, Air Quality, p. XIV.F.5. Eight-hour average background concentration for CO is 7.1 ppm for 1985, based on monitoring data, and has been estimated at 5.0 ppm for 2000 and 2020 based on regional emissions projections for 2000.

The eight-hour federal and state CO standard is 9 ppm; the one-hour state standard (more stringent than the federal one-hour standard) is 20 ppm. The concentration in excess of the standard is underlined.

SOURCE: Baseline Environmental Consulting, Inc.

Alternative N. CO concentrations at selected intersections analyzed would be comparable to those identified for Alternative A, except for Third and Berry Streets, where the estimated CO concentration would be highest for Alternative N.

Build-Out/2020

All Alternatives. CO concentrations at the selected intersections listed in Table VI.F.4 would be the same or only slightly greater in 2020 than in 2000. No violations of standards are projected at these intersections in 2020.

Consistency with the 1982 Bay Area Air Quality Plan

The strategies of the 1982 Bay Area Air Quality Plan (Air Quality Plan) are to reduce HC and CO emissions through controls on stationary sources (reduction of HC only) and motor vehicles, and through transportation improvements./8/ The goal of the Air Quality Plan is to achieve federal O_3 and CO standards. Consistency of Mission Bay with the Air Quality Plan is evaluated with respect to proposed transportation improvements, proposed land use development, and land-use/demographic-growth assumptions of the Air Quality Plan, as contained in BAAQMD guidelines and Projections 83./23,24/

Mission Bay would be consistent with some elements of the Air Quality Plan, through its emphasis on public transit for all Alternatives, and pedestrian and bicycle circulation for Alternatives A and B, as described in VI.E. Transportation, p. VI.E.61. Regional and local transportation systems in and around and the Project Area would be constructed as described in VI.E. Transportation, p. VI.E.59.

With regard to land use measures needed to reduce auto emissions, the Air Quality Plan recommends that cities and counties consider modifying their general plans to encourage development in urban service areas, to encourage mixed-use development and infill on vacant land at densities sufficient to support transit, and to encourage rehabilitation and reuse of older buildings. All of the Alternatives would be largely consistent with these recommendations. Alternative A, as the mixed-use Alternative, would be the most consistent of the three.

Mission Bay would be inconsistent with the Air Quality Plan with respect to land use/demographic growth projections for the Project Area. Projections 83 forecasts for the City and County of San Francisco assumed that in 2000, 16 acres in the Project Area would be developed for office use and 153 acres would be developed for 1,500 residential units; the rest of the Project Area was assumed to remain in existing uses./25/ Projections 83 does not forecast beyond 2000, so no comparison for 2020 can be made. However, on the basis of projections for 2000, all Alternatives would represent a substantially more-intensive use of the Project Area than was assumed in Projections 83.

In all, Mission Bay therefore would not be entirely consistent with the goals of the Air Quality Plan, because full development would generate larger amounts of pollutants than the Air Quality Plan assumed.

EMISSIONS FROM STATIONARY SOURCES

The Alternatives include development of S/LI/RD, M-2 Industrial and Port-Related/M-2 uses in portions of the Project Area. Only a small amount of that type of space would be present in Alternative B. Some light industrial uses occupying space under those designations may be direct sources of air pollutant emissions; the types and amounts of pollutants emitted cannot be described, because specific uses are unknown, and are likely to change over time. The uses would be subject to BAAQMD regulations and may require air quality permits to operate.

THE GREENHOUSE EFFECT

The greenhouse effect is one of the basic processes through which the atmosphere is warmed, and it has been occurring for as long as the Earth has had an atmosphere. Some people have suggested that the greenhouse effect should be called the atmospheric effect because of the way it works. Much of the short-wave radiation (sunlight) reaching the Earth passes through the atmosphere to strike the Earth's surface, where it is either reflected or absorbed. The absorbed energy is then reradiated as long-wave radiation (heat), which various constituents in the atmosphere can absorb. If this process did not occur, the average temperature at the Earth's surface would be about 40°C cooler than it is. Some gases absorb radiant energy (at either short or long wavelengths) and others do not. Gases which absorb the long-wave radiation emitted by the Earth at the surface are often referred to as greenhouse gases. An increase in the amount of greenhouse gases present in the lower atmosphere would, therefore, lead to an increase in the lower atmosphere's ability to retain heat, and a subsequent increase in average global surface temperatures. This is why the greenhouse effect has become such an important issue. As

- a result of human activities, concentrations of greenhouse gases in the atmosphere have been and are expected to continue increasing, resulting in increased average global temperatures, along with accompanying climatic and social changes.

- Of the greenhouse gases, carbon dioxide (CO_2) is most abundant in the atmosphere and would have the most effect on temperature. CO_2 is an important constituent of the Earth's atmosphere, and is required by plants much as oxygen is required by animals for survival. CO_2 levels are increasing worldwide as a result of the burning of fossil fuel (coal, oil, etc.) and through depletion of the world's forests, especially tropical rain forests (deforestation). Pre-industrial CO_2 levels are estimated to have been 270 parts per million by volume (ppmv); present levels are about 340 ppmv. Estimates of future CO_2 concentrations vary widely. Computer models predict a concentration of between 367 and 531 ppmv by the middle of the next century. Future concentrations will depend on many factors that are difficult to predict, including future levels of CO_2 emissions and the rate of deforestation. CO_2 concentrations and global temperatures have been higher at times in the Earth's approximate five-billion-year history and have been lower at other times. Other greenhouse gases include methane, nitrous oxide, chlorofluorocarbons, and ozone; by the year 2030, the combined effect of these gases is expected to equal the effect of CO_2 alone.

- Estimates of overall global temperature increases (between 1.5 and 4.5°C) and subsequent climatic changes vary, but most scientists agree that the results potentially could be catastrophic. These changes could include a partial or complete melting of the arctic ice cap and thermal expansion of the oceans, resulting in an increase in the mean sea level and subsequent flooding of low-lying coastal areas; a change in regional climates (not only in temperature, but in precipitation and in evaporation rates), resulting in changes in agricultural uses. Increasing CO_2 levels may also directly affect agriculture in some regions. It is unknown whether this would be a beneficial effect or a negative effect, as increasing plant sizes may cause higher production yields, or increasing competition from weeds may bring lower production. The total effects are not known but, as computer models become more sophisticated and as the initial effects of the temperature change start to appear, expected changes associated with the greenhouse effect will become more evident.

- Mission Bay (and regional growth in general) would result in increased consumption of fossil fuels, with an attendant increase in release of CO_2 into the atmosphere. This would occur in conjunction with any urban development, the magnitude of the effect being related roughly to the size of the development. On a global scale, however, the contribution of the project to the greenhouse effect would not be measurable.

ODORS

Because odors result from existing conditions or could occur over the build-out period and beyond, they are discussed below specifically for each Alternative at build-out.

Channel Street Pump Station

Potential odor problems in the Project Area are associated primarily with the Channel Street Pump Station operated by the City and County of San Francisco Department of Public Works, Bureau of Water Pollution Control. Mission Bay proposes to develop residential or commercial areas within 200 feet of the Pump Station, potentially exposing future residents and workers to odors generated by wastewater pumping. No odor complaints have been reported for the Pump Station since its construction in 1980./26/ Similar pump stations located in residential areas in other portions of the City have not experienced any odor problems. Hydrogen sulfide odors, the most serious potential odor problem, are rarely associated with pump stations. Odor emissions are regulated in San Francisco by the BAAQMD.

Odor problems may occur episodically, when there has been a mechanical failure. In the event of a mechanical failure, the Pump Station would be shut down immediately. The Channel Street Pump Station has not experienced any failures since its construction./26/ The Bureau of Water Pollution Control recently completed installation of preventive odor control measures at the Channel Street Pump Station, using chemical treatment.

Another source of potential odor associated with the Pump Station would be stormwater overflow events in the City's combined sewage/stormwater system. The City currently has insufficient capacity to handle stormwater runoff. As a result, overflows occur during periods of rainfall. Overflows may include discharge of unknown amounts of untreated sewage mixed with stormwater to discharge locations in the Bay. The Southeast Area Improvements program has been initiated by the City's Clean Water Program to reduce wet weather pollution in the southeastern section of the City, where shallow channel water and the Bay present environmentally sensitive conditions.

Bay Sediments

A second source of potential odor problems in the Project Area is the sediments underlying the waters of San Francisco Bay in inshore areas such as China Basin Channel. Such odor problems would arise from the production of hydrogen sulfide (H_2S), the "rotten egg" gas, during bacterial decomposition of organic matter under anaerobic (i.e., without oxygen) conditions./27/ Such conditions typically are found in bottom sediments where water circulation and tidal flushing are poor. Warm temperatures and high levels of organic matter -- such as from sewage discharge or accumulations of algae -- also promote H_2S generation. Thus, odor problems would most likely arise in China Basin Channel during warm weather, such as occurs in September and October, or following the discharge of large amounts of raw sewage and street runoff, as occasionally occurs during periods of heavy rainfall. Odor from other inshore areas east of the Project Area are possible, but unlikely.

At concentrations of 20 to 150 ppm, H_2S can irritate the eyes; at slightly higher concentrations, it may irritate the upper respiratory tract. Exposure to H_2S may also affect the nervous system and result in headache, dizziness, and other symptoms. Ambient concentrations of H_2S in China Basin Channel and the Bay due to decomposition of organic matter are of nuisance nature only, and would not be sufficiently high to cause human health effects.

Build-Out/2020

Alternative A. Alternative A would not change substantially the amount of wastewater discharged into the channel, nor would it materially affect the circulation or flushing of the channel. Alternative A, however, would greatly increase the number of residents and workers in the vicinity of China Basin Channel and other inshore areas of San Francisco Bay, increasing the potential for exposure of people to odors.

Alternative B. In regard to potential exposure of people to odors from existing sources, Alternative B would be similar to Alternative A. The three proposed wetlands could become a source of odors to which future residents would be exposed, if the wetlands were not designed to flush properly and avoid accumulation of organic material. Mudflats, such as those proposed to be included in the wetlands, are not normally the source of noticeable levels of H_2S gas./27/ For more information regarding wetlands, see VI.M. Vegetation and Wildlife, p. VI.M.1.

Alternative N. This Alternative, like Alternative B, would leave China Basin Channel itself largely unchanged and the timing, composition, and amount of wastewater discharged into it largely unaltered. This Alternative would result in no new residents and fewer workers than in Alternative A in the vicinity of potential sources of odor, so the potential for exposure would be less.

MITIGATION

Mitigation measures F.1 through F.3, below, address the impacts associated with construction-generated fugitive dust. F.1 recommends measures for which the project sponsor would have the primary responsibility for implementation. F.2 is a measure that would primarily involve the Department of Public Works in coordination with the BAAQMD and the project sponsor. Measure F.3 represents a method for determining whether implemented measures prove to be effective. Measure F.4 addresses operational phase emissions that would be generated by motor vehicle traffic associated with the Alternative. Mitigation measures that specifically address the issue of the potential release of air toxics during site development are in the discussion of hazardous wastes under VI.N. Hazardous Wastes, starting on p. VI.N.39, Measures N.1, N.2, and N.3.

Measure	Alternative	Description
F.1	A,B,N	Execute an effective dust control program for demolition, excavation, grading, construction, and other dust-generating activities. This program would include: – sprinkling all unpaved construction areas with water at least twice per day to reduce fugitive dust emissions by approximately 50%; – imposing speed limits for construction vehicles (e.g., 10 miles per hour) in unpaved areas; – covering hauling trucks containing dirt and debris, and minimizing the distances required for disposal of excess spoils; – covering storage piles of dirt or construction debris adequately with plastic sheeting to prevent wind and water erosion; – using canvas drapes to close building floors during application of mineral-based fire insulation to structural steel frames; and – scheduling major dust-generating activities (such as excavation and demolition) for time periods when local winds are anticipated to be less than 12 mph./28/

Measure	Alternative	Description
		By reducing the amount of airborne dust generated by construction, this program would also reduce the amount of toxic dust particles that might also be contained with other dust particles. However, more stringent measures may be necessary for removal of soils containing hazardous materials.
F.2	A,B,N	Request that the San Francisco Department of Public Works institute a street-cleaning program for streets within one to two blocks of the Project Area perimeter. BAAQMD monitoring in San Jose has indicated that PM_{10} concentrations from construction activities decrease with distance from the source(s); and that ambient air quality impacts from PM_{10} emissions would be negligible at a distance of one or more blocks from the construction project./29/ A street-cleaning program should adequately minimize the potential for disturbance of roadway dust, and be performed during periods of demolition and site development (for example, excavation and grading) activities. Streets should be cleaned particularly during the dry, summer and fall seasons. The Department of Public Works and the project sponsor may develop a program, in coordination with the BAAQMD, to ensure that budgetary, personnel, and equipment resources are available. This program could be based on construction schedule information provided by the project sponsor.
F.3	A,B,N	PM_{10} ambient air quality data measured at the San Francisco BAAQMD station should be analyzed by the BAAQMD to monitor the effectiveness of the above dust control measures. The station is less than one mile west of the southern portion of the Project Area and, as situated, would detect any construction impacts from development in the Project Area./29/ If monitoring data indicates that

Measure	Alternative	Description
		PM_{10} standards, particularly the 24-hour average standard, are being violated, then institute local monitoring to determine whether mitigation measures are adequate. If local monitoring identifies PM_{10} violations due to Project Area construction activities, implement the following additional measures: - Re-phasing construction activities where feasible so that the phases of construction that generate the most dust (excavation and grading) at construction sites in the Project Area do not coincide. - Immediately removing material spilled onto public roadways during hauling operations. - Designating a person or persons to monitor the dust control program and to order increased watering, as necessary, to prevent transport of dust off-site.
F.4	A,B,N	Implement mitigation measures designed to reduce motor vehicle trips, as discussed in VI.E. Transportation Mitigation, p. VI.E.198 to reduce the impact of motor vehicle-generated air pollutant emissions on regional and local air quality, consistent with the goals of the 1982 Bay Area Air Quality Plan.

NOTES

SETTING

/1/ Richard Duker, Meteorologist, Bay Area Air Quality Management District, (BAAQMD), telephone conversation, September 9, 1986.

/2/ The marine layer is that portion of the atmosphere that is greatly influenced by large, nearby bodies of water. Characteristically, this layer remains relatively moist year-round and is more moderate with regards to seasonal temperature changes than surface layers distant from large bodies of water.

/3/ James S. Sandberg, Meteorologist, BAAQMD, telephone conversation, September 9, 1986.

/4/ The lower atmosphere generally cools with increasing height above the surface. Air heated at the surface normally rises until it cools to the temperature of the surrounding air. An inversion is a condition where a warmer layer of air overlies a cooler layer. With an inversion, air heated at the surface is restricted to the layer beneath the inversion.

/5/ For example, estimated potential CO concentrations associated with a proposed project are compared with the state standard for a one-hour averaging time; and the federal standard for an eight-hour averaging time. For ozone, potential hydrocarbon emissions (as a precursor to ozone formation) associated with a project are compared with regional estimates of hydrocarbon emissions. For particulates (as well as nitrogen dioxide and sulfur dioxide), potential project-generated emissions are compared with regional emissions.

/6/ The Bay Area Air Basin includes seven counties -- Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, and Napa Counties -- and portions of two others -- southwestern Solano and southern Sonoma Counties.

/7/ Previously, the primary San Francisco air quality monitoring station was on 23rd Street (near Tennessee Street), also less than one mile from the Project Area. Data through 1985 were compiled at the 23rd Street Station. Monitoring data for 1986 represent a consolidation of measurements taken at the 23rd Street and Arkansas Street Stations.

/8/ Association of Bay Area Governments (ABAG), BAAQMD, and Metropolitan Transportation Commission (MTC), 1982 Bay Area Air Quality Plan, December, 1982.

/9/ The four major program elements of the 1982 Bay Area Air Quality Plan were: use of available control technology on existing stationary sources, restrictions on new sources of emissions, a vehicle inspection and maintenance program, and transportation system improvements.

/10/ BAAQMD, "Ozone Measurements and Trends in San Francisco Bay Area, 1965-1984," Information Bulletin 8-8-85, 1985.

/11/ BAAQMD, "Base Year 1982 Emissions Inventory Summary Report," 1983.

/12/ ABAG, BAAQMD and MTC, "Summary of 1979/80 CO Hotspot Monitoring Program," Air Quality Technical Memo 33, 1980.

/13/ The most intensive hot-spot monitoring program was conducted in the winter of 1979-80 in and around San Jose, an area where traffic density and meteorological conditions combine to produce the most violations of CO standards in the Bay Area. Hot-spot monitoring in San Jose indicated that, during worst-case meteorological conditions, inversions have limited upward dispersion of CO emitted during evening traffic peak hours (ABAG, BAAQMD, and MTC, "Urban Background Carbon Monoxide Levels in the Bay Area," Air Quality Technical Memo 42, 1982). Ambient CO levels resulting from these conditions were combined with local emissions to cause high concentrations at the monitored intersections compared to background CO levels monitored at permanent stations.

/14/ Meeting of BAAQMD, San Francisco Department of City Planning, Environmental Science Associates, Inc., Barton-Aschman Associates, Inc., and Baseline Environmental Consulting, November 22, 1985.

• /15/ The Downtown Plan EIR projected that the eight-hour CO standard would be violated at the intersection of Sixth and Brannan Streets in 1990 and 2000. The monitoring program measured eight-hour CO concentrations between 5:00 p.m. and 1:00 a.m., from December 13 to 28, 1985. This period was selected because historical BAAQMD monitoring data indicated that worst-case meteorology would be likely to occur in December. Eight-hour maximum concentrations in San Francisco historically have occurred between 5:00 p.m. and 1:00 a.m., and traffic volumes would be high due to the holiday season. Traffic volumes were recorded by the City and County of San Francisco Traffic and Engineering Division during the period of hot-spot monitoring. The results of the hot-spot monitoring are shown in Appendix F, Table XIV.F.6, p. XIV.F.7, and are compared with CO levels recorded at the BAAQMD Potrero Hill Station during the same period. These measurements did not record any violation of standards. The data indicate that concentrations at the intersection of Sixth and Brannan Streets were an average of 2.2 times those measured at the BAAQMD's Potrero Hill station. The mean difference in concentration levels between the two stations during this monitoring program was 2.5 ppm.

A review of CO concentrations recorded at the Potrero Hill Station and at the BAAQMD micro-scale station at Ellis Street indicated that in 1985 worst-case meteorology for CO in San Francisco occurred during early October and early November. The maximum CO concentration recorded at the Potrero Hill Station in 1985 was 7.1 ppm (eight-hour average), in November. This peak CO concentration was 3.6 ppm higher than the peak eight-hour CO concentration of 3.5 measured at the Potrero Hill Station during the December 1985 hot-spot monitoring at Sixth and Brannan Streets.

/16/ Thomas E. Perardi, Manager, Research and Planning Section, BAAQMD, telephone conversation, September 8, 1986.

/17/ Current daily trip numbers were provided by Norman Steinman, Senior Associate, Barton-Aschman Associates, Inc., telephone conversation, October 15, 1987. Emissions of HC, NO_x, CO, TSP, and SO_2 are estimated and compared with regional emission levels, as shown in Table VI.F.1. These calculated emissions assume an average speed of 25 miles per hour and BAAQMD-developed composite emission rates contained in their Air Quality and Urban Development Guidelines for Assessing Impacts of Projects and Plans (November 1985), and revised in April 1988.

/18/ Tirlochan Mangat, Manager, Special Projects Section, BAAQMD, telephone conversation, July 10, 1987.

/19/ San Francisco Department of City Planning, Downtown Plan Environmental Impact Report, EE.81.3, certified October 18, 1984.

IMPACT

/20/ U.S. EPA, Compilation of Air Pollutant Emission Factors (4th Edition), EPA/OAP Pub. AP-42, Volume 1, Research Triangle Park, North Carolina, September, 1985.

/21/ California Air Resources Board, "Particulate Matter Inventory, Weight Fractions by Particulate Matter Category," July 27, 1987.

/22/ Projecting county-wide emissions inventories more than 30 years into the future is not possible because of such unknown factors as the availability of fuel, technological advances, and changes in lifestyle, all of which could dramatically influence future emissions. Thus, Project Area emissions for 2020, when compared with county-wide emissions, should be viewed with the understanding that such a comparison assumes that motor vehicle technology will remain the same from 2000 to 2020 and that Mission Bay development would occur during a period when the rest of the county's growth would be offset such that emissions would remain at year 2000 levels.

/23/ BAAQMD, Air Quality and Urban Development Guidelines for Assessing Impacts of Projects and Plans, San Francisco, California, November 1985.

/24/ ABAG, Projections 83: Population, Employment, and Housing Forecast for the San Francisco Bay Area, June 1983.

/25/ Susan Hootkins, Senior Regional Planner and Land-Use Specialist, ABAG, telephone conversation, September 17, 1987.

/26/ Jerry O'Brien, Project Manager, Odor Control, Bureau of Water Pollution Control, San Francisco Department of Public Works, telephone conversation, September 18, 1987.

• /27/ San Francisco Department of City Planning, Canal Systems Special Study for Mission Bay, September 1986, Section IV.

MITIGATION

/28/ Wind speed measurements made in San Francisco and at San Francisco International Airport reveal important characteristics that can be applied to the Project Area. Wind speeds vary throughout the year, with the highest winds occurring in the summer and the lowest in the winter. Wind speeds also have a diurnal cycle, with maximum winds occurring during the afternoon from about 3 p.m. to 7 p.m. Long-term scheduling of excavation should take into account peak seasonal (summer) and diurnal (about 3 p.m. to 7 p.m.) wind speed characteristics, supplemented by forecasts available through either a local forecasting firm or the National Weather Service.

/29/ Dario Levaggi, Bay Area Air Quality Management District, telephone conversation, November 9, 1987.

G. NOISE

SETTING

EXISTING NOISE SOURCES AND NOISE LEVELS

Noise Sources

Major noise sources in the Mission Bay Project Area and vicinity include motor vehicles on major thoroughfares and Interstate 280; freight and passenger trains; freight loading and unloading; ship repair and maintenance; and heavy equipment and machinery operation./1/ Noise in and around the Project Area can be characterized in terms of a relatively steady "background" noise level upon which "intrusive" noises -- isolated noise events that stand out clearly from the background noise -- are superimposed. Background and intrusive noise are two distinct descriptors of the noise environment. Intrusive noise is responsible for much of the annoyance generated by noise sources but, because it is short in duration and intermittent, intrusive noise rarely contributes substantially to the long-term average noise levels upon which community noise standards are based. Background noise can have a wide range of averaging periods, from one-hour averages used to characterize peak-hour traffic noise to 24-hour averaging periods used -- with appropriate adjustments -- to express overall community noise exposure. For a general discussion of what noise is and how it is described, see Appendix G. Noise, p. XIV.G.1.

Intrusive Noise

Intrusive noises in the Project Area and vicinity include train whistles, honking horns, some types of industrial process noises, hammering and banging on metal parts and surfaces, accelerating buses and trucks, and many other miscellaneous noise sources. Accelerating and slowing buses are a prime noise source at the CalTrain terminal at Fourth and Townsend Streets. Four diesel bus lines and one trolley bus line traverse this area during the 4:00 p.m. to 6:00 p.m. peak travel period, generating 104 buses passing Fourth and Townsend Streets./2/ Approximately 12 trains depart and three trains arrive at the CalTrain terminal during the afternoon peak period./3/ The Third and Fourth Street drawbridges generate occasional intrusive noise near China Basin Channel./4/ Additional sources of intrusive noise in the vicinity of Illinois Street are industrial machinery such as conveyor belts, motors, crushers, and heavy equipment. Continental

Maritime of San Francisco, Inc. (CMSFI) east of the Project Area is a major source of occasional, intrusive noise. Concrete plants in the Project Area, one along Third Street and the other at Illinois and Mariposa Streets, are also substantial noise sources.

Background Noise

Traffic on I-280 and Third Street is the primary source of background noise in the Project Area. General human activities associated with warehouse, manufacturing and industrial land uses -- such as machinery operations, diesel trucks, and freight loading/unloading -- also contribute to high background noise levels in the Project Area. Along China Basin Street east of the Project Area, ship repair and maintenance activities also produce noise./5/

Peak-Hour Traffic Noise

Existing peak-hour traffic noise levels were not measured, but were estimated on the basis of existing traffic volumes./6/ Estimated peak-hour traffic noise levels along 11 street segments in and adjacent to the Project Area are shown in the Impact section in Table VI.G.5, p. VI.G.20./6/ Peak-hour traffic noise, in areas where motor vehicle traffic is the dominant noise source, is a good measure of the highest average noise levels (i.e., excluding intrusive noise events) to which the community will be exposed. Portions of the Project Area that are shielded by buildings from major thoroughfares would experience peak-hour noise levels substantially lower than the roadside noise levels presented in Table VI.G.5.

Peak-hour traffic noise in the Project Area is highest along the Third Street corridor; the noise level here is about 73 to 74 dBA, L_{eq}, at roadside. Peak-hour traffic noise is also high along the I-280 corridor; the estimated noise level between Townsend and Mariposa Streets is about 72 dBA, L_{eq}. Peak-hour noise levels of about 66 dBA, L_{eq} along Mariposa Street between Mississippi and Illinois Streets are the lowest in the Project Area. The noise levels on 16th Street between Third and Mississippi Streets, and on Townsend Street between Third and Seventh Streets, both about 67 dBA, L_{eq}, are also low relative to peak traffic noise in other portions of the Project Area. Peak-hour noise levels throughout the Project Area generally are not compatible with residential uses, and are conditionally acceptable for commercial uses, based on the San Francisco Land Use Compatibility Chart discussed below.

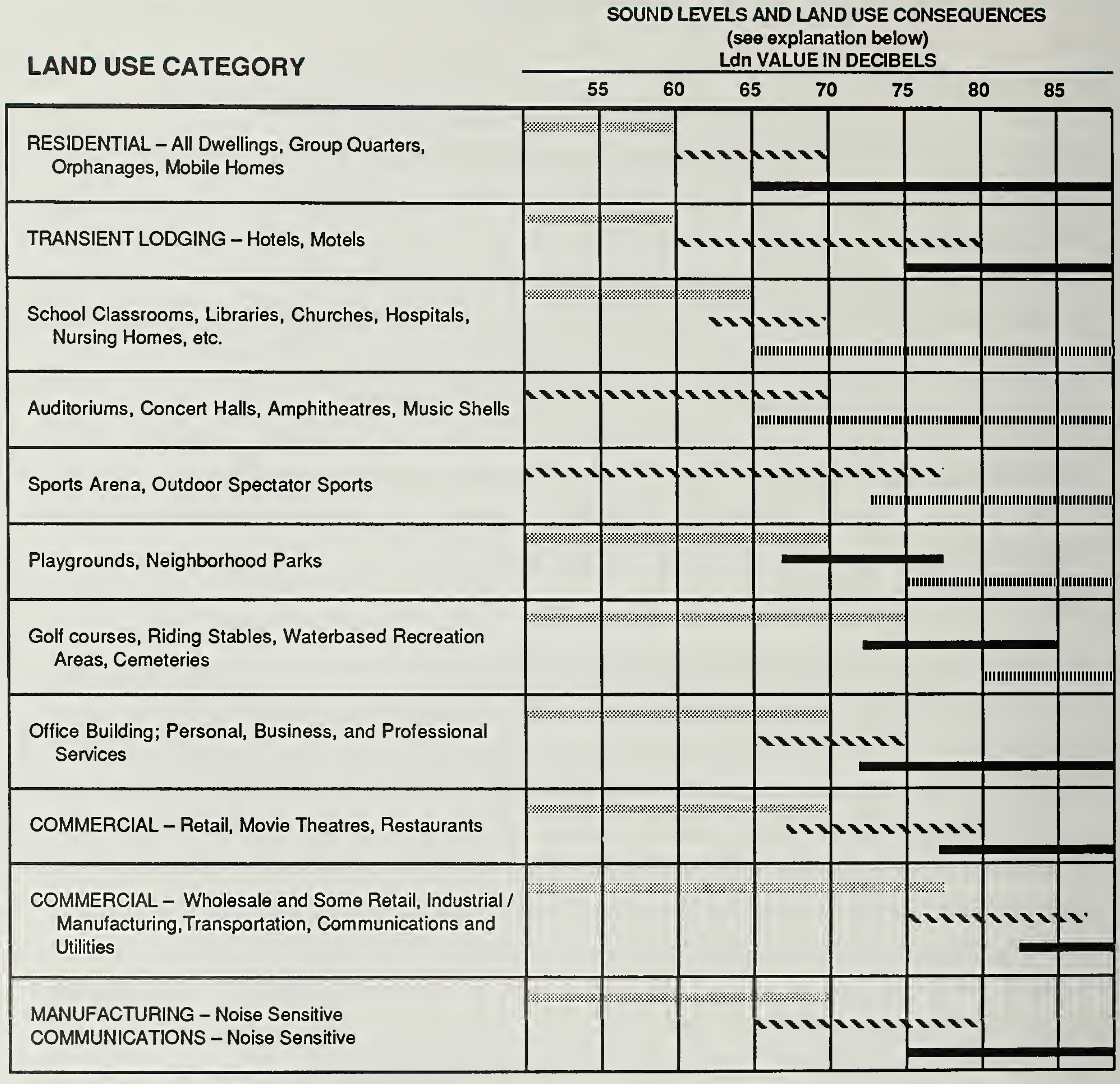
Community Noise

Because traffic is the major noise source in the Project Area, the peak-hour values shown in Table VI.G.5, p. VI.G.20, are good indicators of the maximum one-hour average noise levels along street corridors in the Project Area. Land use compatibility is usually determined, however, by a 24-hour average noise level descriptor such as the day-night average noise level (L_{dn}) used by the City and County of San Francisco as the basis for its "Land Use Compatibility Chart for Community Noise" (see Figure VI.G.1). To calculate the day-night average noise level, 24-hour noise data are required.

To investigate day-night average noise levels, noise levels were measured continuously for 24 hours at six locations in the Project Area. Figure VI.G.2, p. VI.G.5, shows the six noise monitoring locations and dates. Monitoring locations were selected to be representative of a general area. Monitoring results are given in Table VI.G.1, p. VI.G.6.

Community noise levels, expressed as 24-hour average noise levels, are not directly comparable with peak-hour traffic noise. Where traffic is the major source of noise, peak-hour noise levels should be higher than noise levels measured over longer periods. Where non-traffic sources contribute substantially to the overall noise environment, the 24-hour average noise level may be higher than the peak-hour traffic noise level. Calculated noise levels are generally higher than measured noise levels where buildings act as noise barriers, because the noise model does not account for that effect. Calculated noise levels are also often based on worst-case conditions rather than the typical conditions likely to be measured. Taken together, however, the calculated peak-hour (worst-case) traffic noise levels and measured 24-hour average noise levels provide a balanced assessment of the noise environment in the Project Area.

The 24-hour average noise levels measured in the Project Area, presented in Table VI.G.1, are consistent with peak-hour traffic noise levels calculated for major road segments in the Project Area, in indicating a noise environment that is unsuitable for residential uses and conditionally acceptable for commercial uses without implementing noise attenuation measures. The 24-hour average noise level ranges from 75 dBA, L_{eq} on Third Street, a major traffic thoroughfare, to 65 dBA, L_{eq} in the interior of the Project Area away from thoroughfares and other noise sources. When these values are adjusted for enhanced night-time sensitivity to noise, resulting in the day-night average noise levels (L_{dn}), those



EXPLANATION OF LAND USE CONSEQUENCES

░ Satisfactory, with no special noise insulation requirements.

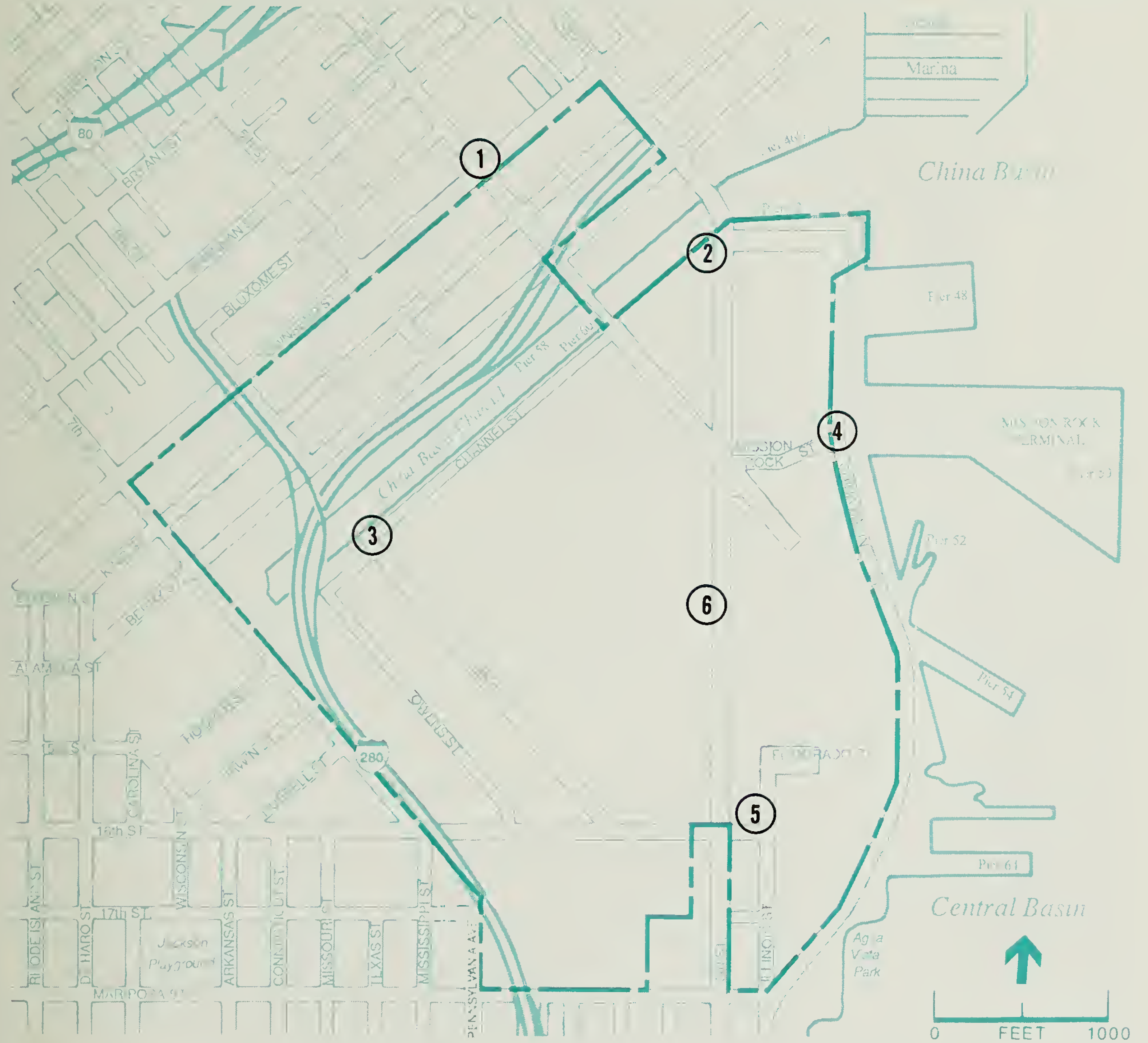
▨ New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design.

▬ New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

▥ New construction or development should generally not be undertaken.

SOURCE: S.F. Department of City Planning, The Plan for Transportation Noise Control, Environmental Protection Element

FIGURE VI.G.1
LAND USE COMPATIBILITY CHART FOR COMMUNITY NOISE


Marina
China Basin
Pier 48
MISSION ROCK TERMINAL
Pier 50
Pier 52
Pier 54
Pier 64
Central Basin
Agua Vista Park
0
FEET
1000
80
280
BRYANT ST
BLUXOME ST
TOWNSEND ST
KING ST
BERRY ST
CHANNEL ST
China Basin Channel
Pier 58
Pier 60
THIRD ST
MISSION ROCK ST
ILLINOIS ST
16th ST
17th ST
MARIPOSA ST
RHODE ISLAND ST
DE HARO ST
CAROLINA ST
WISCONSIN ST
ARKANSAS ST
CONNECTICUT ST
MISSOURI ST
TEXAS ST
MISSISSIPPI ST
PENNSYLVANIA AVE
Jackson Playground
ALAMEDA ST
15th ST
HOOPER ST
IRWIN ST
HUBBELL ST
OWENS ST
7th
1
2
3
4
5
6

— — — MISSION BAY BOUNDARY

①	FOURTH AND TOWNSEND STS.	7:35 A.M. 2/27/86 – 7:35 A.M. 2/28/86
②	TIC-TOC DRIVE-IN	7:05 A.M. 2/25/86 – 7:15 A.M. 2/26/86
③	SIXTH AND CHANNEL STS.	7:20 A.M. 2/25/86 – 7:30 A.M. 2/26/86
④	MISSION ROCK AND CHINA BASIN STS.	7:12 A.M. 3/4/86 – 7:10 A.M. 3/5/86
⑤	16TH AND ILLINOIS STS.	7:10 A.M. 3/6/86 – 7:17 A.M. 3/7/86
⑥	THIRD STREET CORRIDOR	7:15 A.M. 3/18/86 – 7:17 A.M. 3/19/86

Mission Bay

FIGURE VI.G.2
LOCATIONS OF 24-HOUR NOISE MEASUREMENTS

SOURCE: Environmental Science Associates, Inc.

TABLE VI.G.1: EXISTING 24-HOUR AVERAGE NOISE LEVELS IN THE PROJECT AREA, 1985/a/

Location/c/	Noise Descriptors (dBA)/b/ Day-Night Noise Level (L_{dn})	24-hour Average Noise Level (L_{eq})	Peak Noise Level (L_{max})	Major Noise Sources
1. Fourth and Townsend Sts. At the northern corner of the intersection, 50 ft. perpendicular to roadway centerlines, and 150 ft. north of the CalTrain terminal entrance.	74	71	102	- Auto, bus and truck traffic on Fourth and Townsend Streets. - Train idling, acceleration and deceleration. - Loading/unloading freight at wholesale, distribution and warehouse businesses.
2. Near China Basin Channel On the south side of the channel, 50 ft. northeast from the centerline of Third St., 150 ft. southwest of the Third St. drawbridge, about 120 ft. southeast of the center of China Basin Channel.	72	69	94	- Auto and truck traffic on Third St. - Truck stop - Loading/unloading freight at wholesale, distribution and warehouse businesses on Third St. - Drawbridges on Third and Fourth Sts. at the channel.
3. Sixth St. at China Basin Channel 120 ft. southeast of the centerline of the channel on the north side of Sixth, about 625 ft. southeast of the train tracks, and 350 ft. southeast of the I-280 skyway.	69	65	83	- Vehicles on I-280 Freeway - Loading/unloading freight at wholesale, distribution and warehouse businesses on Sixth St. - Traffic on Seventh St. - Trains on tracks between Sixth and Seventh Sts. - Train whistles.
4. Mission Rock St. at China Basin St. (Block 3880) 100 ft. west of Pier 50 and 300 ft. east of Third Street.	68	66	94	- Auto and truck traffic on Third St. - Freight loading/unloading. - Industrial process noise. - Ship repair and maintenance.
5. 16th St. at Illinois St. At the southwest corner of the intersection, 40 ft. south of the 16th St. centerline, 20 ft. west of the centerline of Illinois St.	69	67	98	- Industrial process noise (conveyor belts, crushers, motors, machinery) - Auto and truck traffic on Third St. - Ship repair and maintenance.
6. Third St. between Fourth St. and 16th St. About 1,000 ft. south of Fourth, on the west side of Third (near United Coffee),	79	75	103	- Auto and truck traffic on Third St. - Freight loading/unloading. - Concrete manufacturing.

/a/ Noise measurements were made during February and March of 1986 with a Metrosonics model db-306A Metrologger equipped with windshield. Calibrations were performed prior to each measurement.

/b/ In general, average noise levels between 7:00 a.m. and 10:00 p.m. are one dBA, L_{eq} greater than the 24-hour average, while the average noise level between 10:00 p.m. and 7:00 a.m. is four to eight dBA, L_{eq} less than the 24-hour average. In each case, the peak noise level occurred during the 7:00 a.m. to 10:00 p.m. period.

/c/ See Figure VI.G.2, p. VI.G.5, for exact locations of measurements.

SOURCE: Environmental Science Associates, Inc.

values become 69 and 79 dBA, respectively. The City's land use compatibility guidelines discourage new residential construction in areas where the noise level exceeds 65 dBA, L_{dn}; the guidelines discourage offices above 72 dBA, L_{dn} and manufacturing above 75 dBA, L_{dn}. The City's land use compatibility standards are discussed below under "Noise Standards, Plans and Policies."

Sensitive Receptors

For the most part, the Project Area and immediate vicinity are occupied by industrial and commercial uses that are relatively insensitive to noise. A few isolated land uses are considered sensitive to noise, however, and could be adversely affected by increased future noise levels. The houseboats in China Basin Channel are a residential use. The Recreational Vehicle Park across Fourth Street from the CalTrain Station at Fourth and Townsend Streets and the Washington Hotel, located just outside the Project Area near the CalTrain terminal, are also relatively noise-sensitive land uses. In general, high noise levels can decrease the quality of relaxation and ability to sleep for both temporary and permanent residents./7/

Office, restaurant and recreational uses are considered moderately sensitive to noise. Office uses in the Project Area are located in the area bounded by Third Street on the east, Townsend on the northwest, and Seventh Street on the southwest; the Eye Institute on China Basin Street just east of the Project Area also includes office uses. Restaurants and public shoreline access areas along the channel and China Basin Street also adjoin the Project Area on the east (see also Figure VI.D.3 p. VI.D.12).

Noise Standards, Plans and Policies

Mission Bay would be subject to portions of Title 24 of the California Administrative Code that address interior noise levels for some types of new residential uses; the City and County of San Francisco Noise Ordinance; and the noise-related policies of the Environmental Protection Element of the City's Master Plan.

Title 24 Noise Insulation Standards. This section of the state code (formerly part of Title 25) limits allowable interior noise level in multi-family residential units to 45 dBA, Community Noise Equivalent Level (CNEL)./1/ For new multi-family construction proposed in areas where the existing exterior noise level is greater than 60 dBA, CNEL, it also requires, that an acoustical analysis be prepared to demonstrate that the interior noise level would not exceed 45 dBA, CNEL. The day-night average noise level, L_{dn}, is approximately equivalent to the CNEL.

San Francisco Noise Ordinance (Part II, Chapter VII, San Francisco Municipal Code). This ordinance limits construction noise to 80 dBA at 100 feet, and limits allowable construction noise between 8:00 p.m. and 7:00 a.m. to five decibels above the ambient noise level at the property line, unless the Department of Public Works issues a special permit.

Environmental Protection Element. The Element includes the Plan for Transportation Noise Control, which includes several objectives and policies for controlling traffic noise, the principal source of community noise in the City. Those objectives and policies to be considered for new development in the Project Area are listed in Table VI.G.2.

TABLE VI.G.2: OBJECTIVES OF SAN FRANCISCO PLAN FOR TRANSPORTATION NOISE CONTROL

Objective 1: Reduce transportation-related noise.

- Policy 2: Impose traffic restrictions to reduce transportation noise.
- Policy 5: Retain and expand the electric trolley network.
- Policy 6: Discourage changes in streets which will result in greater traffic noise in noise-sensitive areas.

Objective 2: Minimize the impact of noise on affected areas.

- Policy 1: Promote site planning, building orientation and design, and interior layout that will lessen noise intrusion.
- Policy 2: Promote the incorporation of noise insulation materials in new construction.
- Policy 3: Construct physical barriers to reduce noise transmission from heavy traffic carriers.

Objective 3: Promote land uses that are compatible with various transportation noise levels.

- Policy 1: Discourage new uses in areas in which the noise level exceeds the noise compatibility guidelines for that use.
- Policy 2: Consider the relocation to more appropriate area of those land uses which need more quiet and cannot be effectively insulated from noise in their present location, as well as those land uses which are noisy and are presently in noise-sensitive areas.
- Policy 3: Locate new noise-generating development so that the noise impact is reduced.

SOURCE: San Francisco Department of City Planning, Plan for Transportation Noise Control, Environmental Protection Element of the Master Plan, adopted by the San Francisco City Planning Commission, Resolution 7244, September 1974.

IMPACT

INTRODUCTION

Twenty-four hour average noise levels in the Project Area were measured during February and March of 1986, and are shown in Table VI.G.1, p. VI.G.6. Those measurements indicate that existing noise levels are high in relation to the types of land uses proposed for Alternatives A and B, and to some extent for Alternative N. Development of residential and open space uses in this noise environment would not respond to guidelines in San Francisco's "Land Use Compatibility Chart for Community Noise" (see Figure VI.G.1, p. VI.G.4). The following noise impacts analysis indicates that future noise levels in the Project Area would be noticeably higher regardless of the Alternative. That would be due initially to construction noise and, later, to noise from the projected increase in vehicle traffic accompanying the project. Given these high known and projected future outdoor noise levels, remaining tenants, new residents, and new employees of the Project Area would require protection from noise, which is discussed under Mitigation.

Until build-out is reached, construction activity would be a substantial source of noise in the Project Area. This noise analysis begins with a description of the impacts of construction noise on land uses within and around the Project Area. Noise sources are identified; peak and average noise levels at land uses planned under each Alternative are evaluated. The varying quality and intensity of noise produced by construction equipment, and noise attenuation by intervening buildings, building materials, and distance are considered. Construction noise effects are treated as continuous or intermittent, depending on the source of noise, over the entire build-out period.

In the second part of this analysis, roadside and area-wide (composite) noise levels produced by evening peak-hour vehicle traffic at build-out under each Alternative are estimated and evaluated. Unless otherwise noted, a separate discussion of operational noise impacts in the interim analysis year has not been included because differences between noise conditions in 2000 and 2020 would be insignificant. The results of computer modeling of evening peak-hour vehicle traffic noise for each Alternative are presented and discussed. The effects of future non-traffic noise on sensitive receptors are also discussed. Noise attenuation by exterior walls of buildings has been included in the analysis and discussion of future traffic and non-traffic noise levels. In addition, benefits derived from site planning as it affects outdoor noise levels, especially at open space, have been included in the discussion. These latter statements are necessarily qualitative because specific building dimensions, materials, and orientation have not been determined.

In the last section of this analysis, projected noise impacts are presented in light of existing noise standards, plans, and policies. Specific elements of the Alternatives that conflict with pertinent standards are identified. The Mitigation section, following the noise impacts analysis, suggests measures to minimize identified noise impacts. Appendix G. p. XIV.G.1, discusses the physics of noise propagation; the different types of noise to which Project Area receptors would be exposed; their interactive effects, measurement conventions, and common noise impact mitigation measures; and computer modeling of vehicle noise.

CONSTRUCTION NOISE

Noise Sources

Noise from project construction activities is expected to continue over the build-out period. During that period, Project Area noise levels would vary according to type of construction activities underway, location of activities, and construction methods and equipment used. Table VI.G.3 shows noise levels typical of various construction activities; these noise levels represent composite noise levels resulting from overlapping operation of multiple pieces of construction equipment. Within several hundred feet of construction sites, construction noise would be attenuated by distance and intervening buildings to ambient noise levels, as shown. At those distances, individual sources of noise from within construction site(s), other than intrusive noise events, would fade into background noise and could not be distinguished from it. Construction equipment contributing to the noise levels presented in Table VI.G.3 is shown in Table VI.G.4, p. VI.G.13. Table VI.G.4 includes noise sources such as impact tools that generate intense but intermittent noise. Intrusive noise events resulting from operation of this equipment would be heard at greater distances from the construction site than would general construction noise.

The construction activities, equipment, and noise levels shown in Tables VI.G.3 and VI.G.4 are representative of those that would occur under any Alternative. Potential interior

TABLE VI.G.3: TYPICAL NOISE LEVELS DURING CONSTRUCTION OF LARGE BUILDINGS

Construction Activity	Noise Level at 50 Feet (dBA, L_{eq})/a/	Approximate Distance (ft.) To Reduce Noise to Given Level (dBA, L_{eq})		
		60	65	70
Ground Clearing	84	790	450	250
Excavation	89	1,400	800	450
Foundations	78	400	220	130
Erection	85	890	500	280
Finishing	89	1,400	800	450

NOTE: Noise levels in this table are worst-case levels for typical combinations of construction equipment and activities; noise attenuation methods for construction equipment have not been applied, nor has potential attenuation by intervening buildings between source and receptor been assumed.

/a/ The noisiest piece of equipment is 50 feet from the receptor, and other equipment is 200 feet from the receptor. Noise levels at 100 feet from the noisiest piece of equipment would be about six dBA, L_{eq} lower than those shown above, assuming no noise attenuation by obstructions.

SOURCE: Bolt, Beranek, and Newman, Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, Report Number NTID300.1, for the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C., December 1971.

and exterior noise levels associated with each type of activity are identified, assuming sound attenuation by intervening buildings and construction materials as indicated. Differences in Project Area noise impacts between Alternatives would be due primarily to different timing and quantity of construction, and different distances between construction sites and noise-sensitive receptors. Those differences are described by Alternative in the following subsections. Noise levels perceived outside the Project Area would vary according to the proximity and phasing of construction activities.

Alternative A

Changes in the Project Area infrastructure would generate combined noise levels similar to those presented in Table VI.G.3. Those changes would include removing the I-280 freeway stub and constructing new ramps, relocating the CalTrain Station from Fourth

TABLE VI.G.4: TYPICAL NOISE LEVELS FROM SELECTED CONSTRUCTION EQUIPMENT/a/

Equipment	Noise Level (dBA, L_{eq})		Approximate Distance (ft.) To Reduce Noise to Given Level (dBA, L_{eq})		
	50 Feet	100 Feet	60	65	70
Earthmoving					
Front Loader	79	73	450	250	140
Backhoe	85	79	890	500	280
Bulldozer	80	74	500	280	160
Tractor	80	74	500	280	160
Scraper	88	72	1,260	710	400
Grader	85	79	890	500	280
Truck	91	85	1,800	1,000	560
Paver	89	83	1,400	800	450
Dredging	79	73	450	250	140
Materials Handling					
Concrete Mixer	85	79	890	500	280
Concrete Pump	82	76	630	350	200
Crane	88	82	1,300	710	400
Derrick	88	82	1,300	710	400
Stationary					
Pumps	76	70	320	180	100
Generator	78	72	400	220	130
Compressor	81	75	560	320	180
Impact/b/					
Pile Driver/c/	101	95	5,600	3,200	1,800
Jack Hammer	88	82	1,300	710	400
Rock Drill	98	92	4,000	2,200	1,300
Pneumatic Tools	86	80	1,000	560	320

/a/ Noise levels in this table are worst-case estimates for individual pieces of equipment; no obstructions between source and receptor or special noise attenuation methods for equipment are assumed.

/b/ Impact equipment was not included in the typical noise levels from general construction activities presented in Table VI.G.3.

/c/ The repetitive and intrusive nature of pile-driving noise generally is considered more disruptive than continuous or steady sounds of comparable level.

SOURCE: Environmental Science Associates, Inc., using information from Bolt, Beranek, and Newman, Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, Report Number NTID300.1, for the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C., December 1971, and Jack Golden et al., Environmental Impact Data Book, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1979.

and Townsend Streets to Seventh and Channel Streets, dredging the channel, and constructing a new bridge at Owens Street. Noise generated by those activities, especially intermittent noise from such activities as demolition, would disturb existing sensitive receptors, including houseboat residents./8/ Outdoor noise levels at the houseboats could reach 83 dBA, L_{eq} and probably would not be attenuated to less than 73 dBA, L_{eq} by houseboat walls due to their light-weight construction./9/ Noise at that level could cause adverse physiological effects in people who would be present for prolonged periods during construction. Temporary residents of the Washington Hotel may also be annoyed by this construction activity; these residents would experience indoor noise levels up to 70 dBA, L_{eq}, with open windows. Existing noise-sensitive commercial establishments, located primarily east of the Project Area, probably would not be affected by noise from construction in the Project Area due to distance and the presence of intervening buildings.

Alternative A would require dredging the channel (see VI.L. Hydrology and Water Quality p. VI.L.23), which would generate noise heard by residents of the houseboats and new housing built early in the Project. Indoor noise levels would be 10 to 35 dBA lower than outdoor levels, depending on the materials used in the structure and whether windows were open or closed./9/ Noise levels inside a houseboat with open windows could exceed 69 dBA, L_{eq} depending on the location of the houseboat relative to the dredging activities and the noise-attenuating capacity of the houseboat. That noise level would be annoying and would interfere with conversation. MDR residents south of the channel could be exposed to indoor noise levels of 63 dBA, L_{eq} with windows open, which may interfere with verbal communication. MDR residents could be exposed to indoor noise levels of about 55 dBA, L_{eq}, if windows were open during dredging./8/

Figure VI.K.8, p. VI.K.25, identifies areas that would require piles for foundations. Pile-driving noise originating from the periphery of those areas could be heard as far away as Rincon Hill to the north, Howard Street to the northwest, Route 101 to the west, and 23rd Street to the south. Beyond those areas, pile-driving would not be heard above background noise. Because pile-driving typically occurs for about 5 to ten minutes out of the hour, exposure to this noise source would not be continuous. However, the repetitive nature of the noise and the accompanying vibrations would be disruptive and annoying to remaining tenants and, during later years, to residents. Instantaneous indoor noise levels with open windows could exceed 85 dBA, L_{eq} at any location within the Project Area, depending on the construction site. Indoor noise levels during pile driving would probably reach 64 dBA, L_{eq} with windows closed and 89 dBA, L_{eq} with the windows open, which could interfere with verbal communication. Such intrusive noise events would be very annoying and could disrupt normal daytime activities within 100 feet of the pile driver if indoors with windows open, and up to 800 feet away if outdoors. Outdoor noise levels along the southwestern side of Fourth Street, between Townsend Street and Berry Street, could reach 99 dBA, L_{eq}.

Houseboat residents and pleasure-craft users of the channel could be exposed to outdoor noise levels up to 93 dBA, L_{eq}. Noise levels within these boats would probably exceed 73 dBA, L_{eq} due to their relatively light-weight construction. Noise levels of this magnitude would be annoying and may produce physiological effects, such as a change in motor coordination. Existing restaurants and offices along China Basin Street would be exposed to outdoor noise levels reaching 79 dBA, L_{eq} and indoor noise levels of about 44 dBA, L_{eq}, with windows closed, which would not interfere with most activities. With windows open, verbal communication would be difficult. Pile driving would produce peak noise levels of about 100 dBA, L_{eq} in open spaces adjacent to the construction sites, such as OS-1. Noise at this level would detract from the aesthetic enjoyment of planned open space.

Noise from construction trucks hauling excavated material primarily would affect existing land uses along Third and Mariposa Streets, which would be the main access route to and from U.S. 101 via I-280 (see VI.E. Transportation, p. VI.E.188). Shipments from the East Bay would arrive via the Fifth and Fourth Street ramps. Noise from individual or queued trucks might be noticed by occupants of streetfront buildings. However, noise from truck traffic within the Project Area along Third Street, south of Division Street, would probably not affect the relatively noise-tolerant land uses in that area. Heavy trucks would continue to remove excavated material from the construction sites through 2020. Noise from trucks along Third Street would be undiminished by distance because residents of new housing would be adjacent to roads providing access to construction sites. Interior noise levels could reach 56 dBA, L_{eq}.

Construction planned for Alternative A would produce noise levels similar to those presented in Table VI.G.4, p. VI.G.13. Houseboat residents and pleasure-craft users of the channel would be exposed to outdoor noise levels up to 77 dBA, L_{eq} from excavation and finishing phases of construction activities. This estimate is based on the assumption that construction would be under way about 200 feet away from housing, with no intervening obstructions. Interior noise levels would probably reach 67 dBA, L_{eq} with open windows.

Noise levels this high would make conversation difficult. Existing office and retail space along the northwestern side of the channel would be exposed to exterior noise levels of about 73 dBA, L_{eq} from construction southeast of the channel. Interior noise levels could reach 63 dBA, L_{eq} which may interfere with normal activities. Occupants of offices and restaurants along China Basin Street would probably not notice construction noise, other than pile-driving, until construction of the medium-density residential development east of Third Street was begun.

During later years of development when the interior of the Project Area would have been developed into housing and retail, the closest noise-sensitive receptors to construction activities would be along Third Street, where housing could be about 50 feet away (the approximate width of Third Street). Outdoor noise levels along the western side of Third Street, from Fourth Street to 16th Street, could reach 89 dBA, L_{eq}. Depending on the construction materials used in the buildings, about 35 dBA of attenuation could be provided by the building envelope with windows closed, lowering indoor noise levels to 54 dBA, L_{eq}, which would not interfere with conversation or other normal activities. Other construction in later years would occur northwest of the channel between Fourth and Seventh Streets (perhaps less than 100 feet), exposing nearby houseboat residents to outdoor noise levels of up to 83 dBA, L_{eq}.

Initial Phase of Development

The initial phase of development would produce noise levels similar to those described above, but on a smaller scale. Construction of office and retail space at Third Street and Townsend Street would be heard by temporary residents of the Washington Hotel, where indoor noise levels could exceed 70 dBA, L_{eq}. The channel would be dredged in the initial phase. Construction of housing between Owens and Fourth Streets, southeast of the channel, would probably not disturb houseboat residents, except during pile-driving when instantaneous indoor noise levels could reach 76 dBA, L_{eq}. Construction of S/LI/RD between 15th and 16th Streets would not substantially affect any noise-sensitive receptors. Occupants of the initial phase of development would probably not be affected by noise from infrastructure construction. Indoor noise levels at the MDR south of the channel could reach about 53 dBA, L_{eq} with the windows open during the loudest phases of infrastructure construction. New residents and employees would be affected by construction of later phases of development, as described above.

Alternative B

Infrastructure changes in the Project Area for Alternative B would generate noise levels similar to those described for Alternative A. Under Alternative B, however, the channel would not be dredged. Another difference between Alternatives A and B would be construction under Alternative B of an additional bridge on China Basin Street where the bayfront wetland connects to the bay. Noise from construction of that bridge would go largely unnoticed because there are no noise-sensitive land uses nearby.

Noise generated by pile-driving required for development in Alternative B, (the areas that would require driven piles are shown in Figure VI.K.9, p. VI.K.26), and the areas exposed to noticeable increases in ambient noise levels during construction, would be about the same as those described under Alternative A, above.

Noise produced by soil excavation would be similar to that presented for excavation and construction trucks under Alternative A, above. Excavation would take place over a wider area than for Alternative A, but would be no more noticeable than under Alternative A because of the high existing background noise levels. Noise may be noticeable to houseboat and pleasure-craft users in the channel for a longer period than under Alternative A due to dry-dredging for wetlands development.

The noise generated by construction in the Project Area would be similar to that described for Alternative A. Houseboat residents and pleasure-craft users of the channel would be exposed to noise levels similar to those estimated for Alternative A. Construction of MDR, planned for the northwestern portion of the Project Area, would be heard over background noise almost to Seventh Street. Because this Alternative includes 3,200 more dwelling units than Alternative A, more residents would be exposed to construction-related noise over the full build-out period. These new Mission Bay residents would be exposed to noise levels similar to those discussed for Alternative A.

Initial Phase of Development

During the initial phase of development, noise from construction would be limited to the area south of the channel, bounded by Sixth Street to the east, CalTrain rail lines to the west, and the future Hubbel Street to the south. Early construction activities would be adjacent to existing houseboats, which would be affected by construction noise. Pile-driving, needed for the planned office space, could cause indoor noise levels at the houseboats to reach 76 dBA, L_{eq}. Other construction activities would increase indoor noise levels at the houseboats to about 60 dBA, L_{eq}.

Occupants of the initial phase of development probably would not be affected by noise from any infrastructure construction. Indoor noise levels at the MDR planned for Owens Street could reach about 50 dBA, L_{eq} with windows open. Occupants of this early phase would be affected by construction noise of later phases.

Alternative N

Infrastructure changes for Alternative N would include removal of the I-280 stub and changes in the freeway ramps. Noise produced by those activities would have the same effects as those described for Alternative A.

Pile-driving could be required for construction in areas shown in Figure VI.K.10, p. VI.K.27. This activity would generate short-term intrusive noise of about the same magnitude as that described under Alternative A, above. Noise generated by trucks hauling excavated material from the Project Area also would be similar to that discussed for Alternative A.

The peak noise generated by construction would be similar to that described for Alternative A. Construction of office space planned for the area between Fourth and Third Streets, southeast of Townsend Street, would affect the same areas as described for Alternative A.

The only noise-sensitive land uses in the Project Area under Alternative N would be houseboat residents, and recreational users of the channel and adjoining open space. Outside the Project Area, temporary residents of the Washington Hotel would be exposed to construction noise. During pile-driving, these receptors could be exposed to outdoor noise levels reaching 93 dBA, L_{eq}. Interior noise levels would probably exceed 80 dBA, L_{eq} during individual impacts. This noise would be intrusive and disruptive.

OPERATIONAL NOISE

Peak-Hour Traffic Noise

Traffic would be a dominant source of background noise in the Project Area. Noise heard by pedestrians, tenants, and employees in the Project Area would vary by time of day and location. At times, noise from construction activities would be dominant, with traffic noise contributing to the background noise levels. During the morning and evening peak traffic hours, noise from traffic, as described below, would dominate the local noise environment and construction noise would be less noticeable.

This analysis focuses on noise produced by evening peak-hour vehicle traffic./10/ The noise analysis indicates that traffic is, and would continue to be, the dominant source of outdoor noise in the Project Area following construction. Traffic noise was assessed both in terms of roadside noise levels along major road segments in the Project Area (roadside analysis) and composite peak-hour traffic noise levels in the interior of the site that would result from the contributions of more than one road segment. The results of the composite analysis are presented in Appendix G. Table XIV.G.1, p. XIV.G.4./11/ In the roadside noise analysis, existing and future roadside noise levels along 11 individual road segments were calculated; the results of that analysis are presented in Table VI.G.5. Future noise levels presented in this analysis are worst-case projections based on traffic data (project and cumulative volumes) provided by Barton-Aschman Associates./12/

Peak-hour traffic noise levels estimated for road segments within the Project Area indicate that each Alternative generally would result in noise levels at build-out that were higher than the existing high-noise environment in the Project Area and would become noticeable around 2000. For each Alternative, the areas adjacent to Third Street, from Fourth Street south to Mariposa Street, would become noticeably noisier. Two road segments would become noticeably quieter than existing conditions because traffic would be diverted from them by the reconfiguration of the I-280 ramps: Third Street between Channel and Townsend Streets, and Berry Street between Third and Fourth Streets. Noise levels at specific locations would not be noticeably different among the Alternatives, because of relatively small variations in total traffic volumes among the Alternatives. The noisiest existing location in the Project Area, on Third Street between Fourth and 16th Streets, would not become noticeably noisier under any Alternative. That is, Third Street would continue to be the noisiest area, but noise levels would not become

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TABLE VI.G.5: ESTIMATED COMPOSITE AFTERNOON PEAK-HOUR TRAFFIC NOISE LEVELS (dBA, L_{eq}) ON SELECTED ROAD SEGMENTS, BY ALTERNATIVE, FOR 1985 AND BUILD-OUT/2020/a/

Street Segment/c/	1985	2020 Alternative A	2020 Alternative B	2020 Alternative N
Third Street between Fourth and 16th Streets	74	79 /b/	79	80
Third Street between 16th and Mariposa Streets	73	77	77	79
Third Street between Fourth and Channel Streets	73	76	75	77
Third Street between Channel and Townsend Streets	74	71 -	71 -	72 -
Interstate 280 between Townsend and Mariposa Streets/d/	72	73	73	73
Berry Street between Third and Fourth Streets	70	64 -	64 -	64 -
Mariposa Street between Mississippi and Illinois Streets	66	73	73	76
16th Street between Third and Mississippi Streets	67	72	72	72
Seventh Street between Townsend and 16th Streets	70	71	71	72
Fourth Street between Townsend and Third Streets	69	72	72	73
Townsend Street between Seventh and Third Streets	67	68	68	69

/a/ Modeled based on vehicle volumes given in Transportation Setting and Impact Sections of this report (see Figure VI.E.3, p. VI.E.9). All trucks were assumed to be "heavy trucks"; other vehicles were modeled as automobiles. Noise levels in 2000 would be similar to those reported for 2020 in all cases. Appendix G. p. XIV.G.3, provides more information about the modeling.

/b/ Underlined values are noticeably different (by more than three dBA up or down) from existing conditions. A minus sign indicates a noticeably lower noise level than existing conditions.

/c/ Segments modeled at a reference distance of 15 meters (49 feet) and 50 km/hr (31 mph), unless otherwise noted.

/d/ Reference distance of 50 meters (164 feet), traffic speed of 72 km/hr (45 mph).

SOURCE: Environmental Science Associates, Inc.

noticeably higher there. However, the quietest location in the Project Area (on Mariposa Street) would be noticeably noisier than existing conditions for all Alternatives.

On the basis of traffic noise alone, the noisiest and quietest locations within the Project Area would be the same for all Alternatives. The quietest areas, as shown by the composite noise analysis (see Appendix G. Table XIV.G.2 p. XIV.G.6), which provided more complete coverage of the Project Area than the roadside noise analysis, would be south of China Basin Channel, between Fourth and Sixth Streets, and along the eastern shoreline of the Project Area. The noisiest areas would be near the I-280 overpass, especially at Mariposa Street, and along Third Street south of Fourth Street. While the composite noise analysis is conservative in that it does not take noise attenuation by buildings into account, it is useful in identifying relatively high or low noise portions of the Project Area, and in comparing Alternatives.

Traffic generated by each Alternative would cause the already high noise levels existing in the Project Area to increase and the area exposed to high noise levels to expand. Alternatives A and B would result in smaller areas of increased noise level than would Alternative N. Conversation outdoors would continue to be difficult, and would become more difficult in areas where the existing conditions indicate that conversation outdoors is already marginal./8/ Peak-hour indoor noise levels could reach 70 dBA, L_{eq} in the noisiest portions of the Project Area if windows were open. Maximum noise level increases would occur along Mariposa Street near Third Street (Table XIV.G.2 receptors 23 and 24, p. XIV.G.6) due to the anticipated large increase in vehicle traffic along Mariposa Street.

Noise levels outside the Project Area, but adjacent ot it, are expected to be unaffected (less than a three-dBA change) by Mission Bay traffic, because of the existing high background noise levels in adjacent areas and attenuation by intervening buildings.

Peak-hour roadside noise levels at build-out in 2020 would range from about 64 to about 80 dBA, L_{eq}, relatively independent of the Alternative. The composite noise analysis indicates that background noise levels would be higher than existing conditions throughout the Project Area (except for the previously mentioned areas along Berry and Third Streets) but would not be perceptibly louder in all locations. Noticeable noise level increases would be confined to areas adjacent to and east of Third Street, and south to Mariposa Street.

Alternative A

Under Alternative A, peak-hour automobile traffic in the Project Area would increase by about 3,100 vehicles (17%) and truck traffic would increase by about 1,200 vehicles (100%). Overall, traffic would increase by about 22% over existing conditions. The composite noise analysis indicates that maximum and minimum peak-hour traffic noise levels for Alternative A would be 79 and 64 dBA, L_{eq}, respectively, and would occur in the same areas as under existing conditions (see Appendix G. p. XIV.G.6). The results of the roadside noise analysis, presented in Table VI.G.5, p. VI.G.20, indicate that the minimum noise level of 64 dBA, L_{eq} would occur along Berry Street. The noisiest area would be along Third Street, between Fourth and 16th Streets. The greatest increase in noise level would occur along Mariposa Street between Mississippi and Illinois Streets due to the expected doubling of automobile traffic and five-fold increase in truck traffic./12/

The noise level along Berry Street would be relatively low due to the expected 74% decrease in traffic from existing conditions along that segment. The quietest areas in the Project Area would be midway between I-280 and Fourth Street, along China Basin Channel and along China Basin Street. Peak-hour traffic noise levels in these areas would be about 65 to 66 dBA, L_{eq}. Both the roadside noise analysis (Table VI.G.5, p. VI.G.20) and the composite noise analysis (Table XIV.G.2, p. XIV.G.6) indicate that noise levels along Third Street between Channel and Townsend Streets would decrease. Noise levels along this segment may decrease by one to three decibels due to the expected 47% decrease in truck traffic there./12/

Traffic noise generated by Alternative A would have no noticeable effect on open spaces along China Basin Channel (OS-3, OS-4, OS-6) or the proposed park at China Basin (OS-1) due to buffering by intervening buildings and to distance attenuation. Noise levels in those areas would increase by no more than two dBA, L_{eq}. Houseboat residents on the channel would not experience noticeable noise level changes due to traffic. Noise levels in the "central square" area (OS-5) of the project would increase noticeably from 65 to 69 dBA, L_{eq} because of increased automobile and truck traffic along Third Street. Outdoor noise levels at OS-10 would reach 71 to 72 dBA, L_{eq} because traffic noise from 16th Street would not be attenuated by intervening buildings. Noise levels at OS-7 and OS-8 also would exceed 70 dBA, L_{eq} during the peak traffic period because vehicle noise would not be substantially attenuated.

Alternative B

Alternative B would result in noise levels similar to those under Alternative A. As for Alternative A, the largest increase in peak-hour traffic would occur along Mariposa Street due to a 93% increase in autos and a five-fold increase in trucks. Also like Alternative A, traffic along Berry Street would decrease by about 75%. Overall, traffic would increase about 18% over existing conditions. Portions of the proposed mid-channel wetland would be the quietest outdoor areas in the Project Area. Exceptions would be areas adjacent to the I-280 overpass, such as the intersection of Sixth and Channel Streets, OS-3, and the two-acre open space (OS-4) planned for under the I-280 overpass. At those locations, composite traffic noise levels would be up to 70 dBA, L_{eq}, on the assumption of no building attenuation, and passive recreational activities could be disrupted. Other open spaces in the Project Area would be buffered from traffic noise by intervening buildings. OS-1, OS-2, and OS-5 would be relatively sheltered from major traffic arteries. Noise levels there would be about 66 dBA, L_{eq}. The other open spaces OS-6 through OS-11 would be partially attenuated by traffic noise or would be located adjacent to roadways that are not expected to carry high traffic volumes. Noise levels in these areas could range from 65 to 75 dBA, L_{eq}, during the peak hour.

Alternative N

Alternative N would result in the highest noise levels in the Project Area. Although peak-hour automobile traffic would increase only by about 10% in the Project Area, truck traffic would be about three times the 1985 level, and would be the major source of traffic noise. The highest peak-hour traffic noise level in the Project Area would be 80 dBA, L_{eq} and the minimum would be 64 dBA, L_{eq}. Noise levels would be indistinguishable from other Alternatives due to differences of less than three dBA, except along Mariposa Street where the roadside noise analysis indicates a three-dBA increase due to a 15-fold increase in peak-hour truck traffic. Compared to other Alternatives, Alternative N would result in noticeable increases in noise level, relative to existing conditions, over the largest portion of the Project Area because of the greater percentage of truck traffic. Areas adjacent to Third Street, south of Fourth Street, would be exposed to peak-hour traffic noise levels up to 80 dBA, L_{eq}. The intersection of Townsend and Fourth Streets would be exposed to traffic noise levels up to 76 dBA, L_{eq}. A 10-dBA increase (a perceived doubling) in the noise level would occur along Mariposa

Street between Minnesota and Illinois Streets. The lowest peak-hour traffic noise level, 66 dBA, L_{eq}, would be found along China Basin Channel.

Open spaces along China Basin Channel would be among the quietest areas in the Project Area. The lowest noise level estimated by the composite noise analysis, 66 dBA, L_{eq}, is located midway between Sixth and Fourth Streets, along Channel Street. Toward each end of Channel Street, noise levels would increase because of vehicle traffic.

Non-Traffic Noise

Relative to traffic noise levels, non-traffic noise would be more random in its occurrence, typically of shorter duration, and wider in the range of noise levels produced. Non-traffic noise may occur at any time of day and include intrusive noise from whistles and machinery. Existing sources of Project Area noise other than traffic include industrial/commercial process noise and miscellaneous noise. The primary non-traffic noise is from maritime activities along the shoreline east of Third Street, passenger and freight trains at the CalTrain station and along the associated rail lines, and various industrial processes. During the course of Project Area development, some of these noise sources would remain in the Project Area and continue to add to the background noise level of the area, while others would be eliminated. That transition is described in VI.B. Land Use, Business Activity and Employment, p. VI.B.93. This section identifies noise sources that would remain during development, and describes the noise levels that would be produced by them.

Alternative A

No existing businesses would remain in the Project Area by 2020. Prior to 2020, existing businesses east of Third Street, between 16th and Fourth Streets, and those south of 16th Street could still be present. The Kaiser Sand and Gravel concrete manufacturing plant now occupies the area east of Third Street between 16th and Fourth Streets. Noise levels measured in the vicinity of this plant, and reported in Table VI.G.2, p. VI.G.9, reached a high of 103 dBA, with a 24-hour average noise level of 75 dBA, L_{eq}./13/ Noise at that level would continue after occupancy of commercial and residential uses in the Project Area and would affect residents along Third Street. Maximum interior noise levels at MDR housing across Third Street from the plant could reach 87 dBA, L_{eq} with the windows open. Warehouses are located south of 16th Street, so trucks would be the primary future noise source. Truck noise and its effects on noise sensitive receptors are discussed above in Traffic Noise and Construction Noise.

Non-traffic operational noise sources would include maritime activities at the pier areas, but those sources would gradually be replaced with commercial and recreational development along the shoreline. Some maritime businesses may have relocated to bayfront areas south of the Project Area, where their presence would produce noise levels similar to those measured and reported in Table VI.G.1, p. VI.G.6. Were maritime activities to remain on the piers, they could produce peak outdoor noise levels of 94 dBA, L_{eq}, as shown in Table VI.G.1, p. VI.G.6. Intermittent intrusive noise of that magnitude would be superimposed on the background noise level of about 70 dBA, L_{eq} in the area of the proposed park at China Basin (OS-1) and would detract from enjoyment of the area. In addition, if housing planned for the area east of Third Street were completed and inhabited prior to the relocation of maritime facilities, these residents could be exposed to intermittent interior noise levels up to 84 dBA, L_{eq}, if windows were open. Noise at that level would be annoying and would interfere with conversation and daytime sleep. The open space corridor with biking and walking path (OS-11) planned for the area between the Port-related/M-2 and MDR land uses would have no effect on noise levels from the port area because of its narrow width (about 25 feet). The anticipated mix of commercial and residential land uses would probably not present new noise sources that would be noticeable above the relatively noisy background levels expected. In other portions of the Project Area, noise-generating land uses could locate in S/LI/RD space.

Relocation of the CalTrain commute station to an area near Seventh and Channel Streets would not significantly affect average noise levels at the new station location, because trains currently pass that location and generate noise while accelerating and decelerating. Relocation would reduce noise levels along the segment between the new station and the old station at Townsend and Fourth Streets, because railroad use would cease there.

Noise-sensitive receptors within the Project Area closest to the new CalTrain station would be houseboat residents and residents of MHDR along Owens Street. Maximum outdoor noise levels at the houseboats could reach 72 dBA, L_{eq} from the intermittent noise of train accelerations and decelerations; instantaneous noise levels from train whistles, could reach 87 dBA, which would be intrusive. These noise levels would be similar to those produced by trains under existing conditions. Houseboat residents would continue to be exposed to unattenuated noise, because there would be no buildings to shield them from CalTrain activities, and the station itself would not shield noise from locomotives. Noise levels within houseboats could reach 62 dBA, L_{eq}, for short periods which would interfere with conversation.

Recreational users of the 0.5-acre open space planned for beneath the I-280 overpass (OS-8) would be exposed to CalTrain noise levels up to 70 dBA, L_{eq}. Noise at nearby MHDR would be partially attenuated by the planned S/LI/RD development between the railyard and Owens Street. Still, indoor noise levels in the housing development could reach 52 dBA, L_{eq}, if windows were open during periods of rail activity. This noise could be reduced to 37 dBA, L_{eq} or lower by closing the windows. Interior noise levels at the S/LI/RD buildings could reach 78 dBA, L_{eq}, if windows were open. If windows were closed, or not installed on the rail side of the building, interior noise levels could be reduced to below 53 dBA, L_{eq}.

MUNI Metro light rail vehicles (LRVs) and buses would be additional sources of noise in the Project Area. Noise levels from buses and trolleys measured at 35 feet range from 70 dBA, L_{eq}, for electric buses, to 85 dBA, L_{eq}, for diesel buses./14/ Articulated buses and MUNI LRVs reportedly generate noise levels up to 82 dBA, L_{eq}./14/ No noise-sensitive receptors would be located along the proposed King Street line in Alternative A, but residents of Owens Street housing may be exposed to outdoor noise levels from accelerating diesel buses of up to 86 dBA, L_{eq} at 35 feet. Interior noise levels, with windows open, could reach 76 dBA, L_{eq}, at streetfront residences, which would interfere with conversation and potentially cause physiological effects such as changes in motor coordination because of the intermittent nature of the noise.

Alternative B

Under Alternative B, at build-out most of the Project Area would be devoted to residential uses and open space. No port-related maritime land use would remain in the Project Area east of Third Street. Existing pier activities would produce noise and affect nearby open space and residents, as described for Alternative A, were they to remain after development of those areas.

Housing located along Owens Street would be affected by noise from the relocated CalTrain commute station. Residents would benefit from shielding to be provided by planned retail development along Hooper Street and the office space planned for Owens

Street. Maximum interior noise levels at MDR in that area could reach 52 dBA, L_{eq} with windows open, as expected for Alternative A. Houseboat residents would be exposed to high noise levels, as described for Alternative A.

MUNI Metro service planned for this Alternative would expose noise-sensitive receptors to noise as described for Alternative A. Under Alternative B, however, residents of MDR along King Street would also be exposed to this noise source. As described for Alternative A, MUNI Metro vehicles could generate noise levels up to 86 dBA, L_{eq} at 35 feet. King Street residences could be exposed to interior noise levels of 76 dBA, L_{eq} with windows open, with effects as described for Alternative A.

Alternative N

Land uses similar to current uses, but of increased density, would occupy the entire Project Area in 2020 under Alternative N. Commercial and industrial activities could produce noise levels similar to those presented in Table VI.G.1, p. VI.G.6. If piers adjacent to the Project Area continued to be attractive for maritime use, noise from these activities would be similar to that described for Alternative A. There would be no new noise-sensitive receptors in the area.

Noise sources such as passenger trains, trolleys, and buses from the CalTrain and ship repair at Piers 50 and 54, and heavy equipment operation would remain. Background noise levels from those sources would range from 50 to 61 dBA, L_{eq} at night and 60 to 69 dBA, L_{eq} during the day, with occasional intrusive noise events of up to 100 dBA, L_{eq} from train horns and whistles. The extension of MUNI Metro to the CalTrain Station at Fourth and Townsend Streets would increase noise levels to about 86 dBA, L_{eq}, on King Street as described in Alternative A. MUNI Metro noise would not affect any noise-sensitive receptors in the Project Area.

The only noise-sensitive receptors likely to be affected by noise from those sources would be houseboat residents and users of open space along the channel. Indoor noise levels could reach 59 dBA, L_{eq} at houseboats during the day. Average daytime noise levels in the open space could reach 69 dBA, L_{eq}, which would be disturbing. Tenants of Washington Hotel, on the periphery of the Project Area, probably would not be exposed to higher noise levels than now exist.

NOISE STANDARDS, PLANS AND POLICIES

Title 24 Noise Insulation Standards

On the basis of noise measurements reported in Table VI.G.1, p. VI.G.6, acoustical analyses would be required prior to construction of any multi-family housing in the Project Area under Alternatives A and B to demonstrate that annual average interior noise levels in habitable rooms would be less than 45 dBA, CNEL with the windows closed. The analyses in this EIR do not assume that Project Area buildings would be built to that specification. Interior noise levels have been reported on the assumption that windows would be open and that, if closed, a maximum attenuation of 35 dBA, L_{eq} would result./9/

San Francisco Noise Ordinance

As shown in Tables VI.G.3 and VI.G.4, pp. VI.G.12, and VI.G.13, construction noise levels excluding the use of impact tools could exceed 80 dBA, L_{eq} 100 feet away from construction sites. This temporary noise source would be present at various times and sites throughout the approximately 30-year development of the Project Area under all Alternatives. That level of noise would not be in compliance with the standards of the San Francisco Noise Ordinance (Section 2907b), and would require noise abatement measures as described in the Mitigation section, p. VI.G.30.

Environmental Protection Element

The Element includes the City of San Francisco's Plan for Transportation Noise Control. A primary objective of the Plan for Transportation Noise Control is to minimize the impact of transportation noise on affected areas through site planning and use of special construction materials where necessary./15/ The roadside traffic noise analysis prepared for this EIR indicates that Alternatives A and B would not respond to that objective. Residences fronting on Third Street and Fourth Street would be exposed to outdoor noise levels of up to 79 dBA, L_{eq} and 72 dBA, L_{eq}, respectively. Residences along Townsend Street in Alternative B would be exposed to outdoor noise levels of up to 68 dBA, L_{eq}. Although indoor noise levels could be reduced to 44 dBA with the use of proper construction materials, outdoor activities would be impaired by exposure to this level of noise./8/

Placement of S/LI/RD buildings in the area between 16th and Mariposa Streets near Third Street for Alternative A would provide a more compatible noise environment than the placement of residential units there, as planned for Alternative B. That area is expected to experience the highest noise level increases, and is already exposed to some of the highest noise levels in the Project Area, particularly near Third Street, as shown in the results of the composite traffic-noise modeling in Appendix G. Table XIV.G.2, p. XIV.G.6. The quietest portions of the Project Area under any Alternative would be along the southern shoreline of China Basin Channel and the eastern waterfront, where noise levels would range from 62 to 65 dBA, L_{eq} (see Table XIV.G.2, p. XIV.G.6. Residential uses in those areas, as planned for Alternatives A and B, would be compatible and would respond to the objective. Outdoor noise levels in these areas could still interfere with normal conversation during the peak traffic period.

Another objective of the Plan for Transportation Noise Control is to promote land uses that are compatible with transportation noise levels. To make comparisons to the City's Land Use Compatibility Chart (see Figure VI.G.1, p. VI.G.4), day-night noise levels (L_{dn}) are needed. Those levels were reported in Table VI.G.1, p. VI.G.6. The minimum level measured in the Project Area was 68 dBA, L_{dn}; the maximum was 79 dBA, L_{dn}. According to the Land Use Compatibility Chart, those noise levels generally indicate that construction of new housing should be discouraged in the Project Area. If housing were built, the Plan for Transportation Noise Control would require that a detailed analysis of noise-reduction requirements be performed and that needed noise insulation features be included in the design.

Under the Plan for Transportation Noise Control, all portions of the Project Area also would require detailed analysis of noise-reduction requirements for office buildings; noise insulation would need to be included in the design. Commercial land use (other than offices) would be compatible with this objective throughout the Project Area without special noise insulation requirements, except for Third Street between Fourth and 16th Streets, where a detailed analysis of noise reduction requirements would be required, with noise insulation features included in the design.

MITIGATION

There are three approaches to reducing the level of noise to which receptors are exposed: reduce the sound level at the source, provide the receiver with shielding, and alter the path along which the sound is transmitted. Mitigation Measures G.1, G.2, and G.3, address the first method. Mitigation Measures G.4, G.5, and G.6 focus on means to protect receptors from high noise levels. These measures include use of building materials that reduce noise and site planning to locate noise-sensitive land uses in areas of lower noise levels. Finally, Mitigation Measures G.7, G.8, and G.9 suggest the use of barriers and berms as means to impede the transmission of noise. None of the following measures is intended to be exclusive to any other; they should be used together as appropriate and feasible.

Measure	Alternative	Description
G.1	A,B,N	During construction, comply with the San Francisco Noise Ordinance (Section 2907b), which requires that each piece of powered equipment, other than impact tools, emit a sound level of not more than 80 dBA at 100 feet. To reduce impacts from non-pile driver construction noise, require the general contractor to implement the following measures: muffle and shield intakes and exhausts, shroud or shield impact tools such as jackhammers and use electric-powered rather than diesel-powered construction equipment, as feasible, so that noise would not exceed limits stated in San Francisco's Noise Ordinance (Article 29, San Francisco Administrative Code, 1972). Construct barriers around the site and around stationary equipment, such as compressors, which would reduce construction noise by as much as five dBA. Locate stationary equipment in pit areas or excavated areas, as these areas would serve as noise barriers. In general, the most important noise control device for power equipment is an optimal engine exhaust muffler. With feasible noise control such as that, most equipment

Measure	Alternative	Description
		can be quieted by up to 10 dBA, L_{eq}. If the noisiest piece of equipment used to calculate the noise levels presented in Table VI.G.4 were quieted by 10 dBA, L_{eq}, the loudest phase of construction would be excavation and finishing at 76 dBA, L_{eq} at 50 feet. Assuming that the closest receptor would be about 100 feet away, indoor noise levels, with windows open, would still reach about 60 dBA, but with windows closed, could be quieted to 35 to 45 dBA, L_{eq}, depending on the quality of building material and window type.
G.2	A,B,N	The operation of pile-drivers is regulated in Section (2907c) of the San Francisco Noise Ordinance, which enables the City to order special abatement procedures, such as equipping the machines with intake and exhaust mufflers, predrilling of pile holes, erection of enclosures around the point of impact, use of vibratory pile driving and restricting the hours of operation, in order to reduce the levels and duration of exposure. Although noise reductions of 20 to 30 dBA may be achieved with use of one or more of these measures, all quieting methods are not applicable to each construction site. Means to quiet pile-driving noise should be discussed with the engineers in charge of construction.
G.3	A,B,N	Vehicle traffic throughout the Project Area represents the major source of existing and future noise. Although the City cannot control the level of noise produced by privately owned vehicles, it can control which City-owned transit vehicles are used in the Project Area, where the routes are located, and how tracks are installed. If possible, the MUNI electric bus should be used because it has been shown to be the quietest. MUNI Metro light-rail

Measure	Alternative	Description
		vehicles (LRVs) are generally quieter than diesel buses and trucks, and proper track installation can reduce noise and vibration by up to 15 dBA.
G.4	A,B,N	Shield noise-sensitive receptors from long-term high noise levels that reach the exterior of their living and working spaces. Common shielding methods include increasing the thickness and stiffness of the wall or window, inserting an air space within the wall or window, increasing the thickness of the air space, widening the spacing between wall studs, staggering wall studs so that none are attached to both interior and exterior panels, and using resilient/noise absorbing materials within walls. The ability of various wall and window designs to attenuate noise is presented in note 9, p. VI.G.38. These noise attenuating abilities will be reduced by the presence of doors, vents, mail slots, open windows, and other cracks or holes. Such openings should be avoided on walls that are exposed to high noise levels. If windows are present, they should be permanently sealed and mechanical ventilating systems should be used. If doors are located on these walls, they should be solid core, floors should be carpeted, a vinyl seal should cover the door-to-door frame air space, and a threshold closer should be installed. Some of these improvements could increase the cost of residential development.
G.5	A,B,N	Use site planning considerations to help prevent high noise levels from reaching the exterior walls of living spaces. Simple architectural design approaches, such as placing less noise sensitive spaces such as corridors, storage areas, bathrooms, and kitchens on exterior walls, where appropriate, would provide additional mass and air space

Measure	Alternative	Description
		for noise attenuation. Bedrooms and living rooms would then face away from the major noise sources (such as Third and Fourth Streets). In addition to careful planning of interior spaces relative to noise sources, design entire buildings to prevent or impede noise reaching outdoor common areas and indoor noise-sensitive areas. Buildings should present barriers to noise sources and "open" onto areas that do not contain noise sources. Where feasible, the distance between source and receptor could be increased, although noise reductions are small (3 to 4.5 dBA, depending on the hardness of the ground surface) for each doubling of distance from mobile noise sources. Noise-compatible land uses such as parking areas, utility and maintenance facilities, and some types of open space, could be located between noise sources and sensitive receptors.
G.6	A,B	Move housing from areas along Third Street to portions of the Project Area identified as being exposed to lower future noise levels, primarily along China Basin Channel. Third Street would continue to be the noisiest corridor in the Project Area. If housing cannot be moved from this area, ground-floor residences should be discouraged and replaced with commercial or retail uses. This replacement could occur along other traffic corridors where residences are planned, such as Fourth Street between the channel and Third Street, and along Mariposa Street, for Alternatives A and B, and along Townsend Street for Alternative B. This measure could affect the ability to maintain the housing programs included in the Alternatives, or could lead to higher housing densities in greater areas of the site.

Measure	Alternative	Description
G.7	A,B,N	Construct barriers other than buildings to lessen the magnitude of noise levels that would reach building exteriors. Earthen spoils from building excavations could be used to create berms along streets that would shield open spaces from noise sources.
G.8	A,B	Use earthern berms along Third Street to help alleviate the exposure of Third Street residents to vehicle traffic noise levels. Earthen berms may attenuate noise levels within property lines by up to 23 dBA. Alternatively, set housing units back from Third Street and establish less noise-sensitve land uses at ground level. Concentrate common areas such as laundry facilities, storage, and maintenance / service areas along the sides exposed to vehicle traffic at the upper-level.
G.9	A,B	Protect houseboat residents of the channel from high noise levels from the relocated CalTrain station by providing earthern berms or walls at some point between the station and the channel. Placement of such structures on the northern side of Owens Street would also help to reduce traffic noise originating there.

NOTES

SETTING

/1/ Environmental noise is measured in units of decibels (dB). The dBA, or A-weighted decibel, refers to a scale of noise measurement that approximates the range of sensitivity of the human ear to sounds of different frequencies. The normal range of human hearing extends from about 10 dBA to about 140 dBA. A 10-dBA increase in the level of a continuous noise represents a perceived doubling in loudness; a 3-dBA increase is barely noticeable to most people, outside of laboratory conditions. Speech is typically about 60 to 65 dBA.

Environmental noise fluctuates in intensity with time, and is typically described as a time-averaged noise level. The three descriptors of noise used herein are L_{eq}, L_{dn} and L_{max}. L_{eq}, the energy equivalent noise level, is a measure of the average energy content (intensity) of noise over a given period. L_{dn}, the day-night average noise level, is an index, based on a 24-hour average, of the energy content of the noise, with a ten-dBA "penalty" added for nighttime noise (10:00 p.m. to 7:00 a.m.), to account for the greater sensitivity of people to noise during this period. The L_{max} is the peak noise intensity measured during a given period of time.

CNEL, the Community Noise Equivalent Level, is similar to the L_{dn} but with an additional five dBA "penalty" added to evening noise (7:00 p.m. to 10:00 p.m.). In practice, L_{dn} and CNEL values for the same noise event usually differ by less than two dBA.

/2/ These bus lines, the 30-STOCKTON, 15-THIRD, 42-DOWNTOWN LOOP, and 32-EMBARCADERO, are described in detail in VI.E. Transportation, p. VI.E.14.

/3/ The afternoon peak period for CalTrain is between 3:00 p.m. and 5:55 p.m., and evening peak hour is between 4:50 p.m. and 5:50 p.m. Afternoon peak direction is from San Francisco to San Jose. During this period, ten trains leave San Francisco for San Jose and six trains leave San Jose for San Francisco. Morning peak period is between 6:10 a.m. and 8:40 a.m., and morning peak hour is between 7:40 a.m. and 8:40 a.m. Morning peak direction is from San Jose to San Francisco. Eight trains leave San Jose for San Francisco during the morning peak period and four trains leave San Francisco for San Jose during this period. CalTrain: Peninsula Timetable, April 3, 1988.

/4/ Noise generated at the Third Street Bridge includes warning bells and a siren to alert vehicular traffic of the bridge's operation, and a siren to alert navigational craft of the bridge's operation. Noise generated at the Fourth Street Bridge includes two sirens, to alert vehicular and navigational traffic of the bridge's operation. The Third Street Bridge is raised and lowered approximately 40 to 45 times a month, and the Fourth Street Bridge is raised and lowered approximately 25 times a month; both bridges operate 24 hours per day. (Patrick Petersen, Station Engineer, San Francisco Department of Public Works, telephone conversation, February 21, 1986).

/5/ San Francisco Department of City Planning, Pier 50 Drydock Negative Declaration, 84.124E, San Francisco, California, September 7, 1984.

/6/ The Federal Highway Administration Model SNAP1 was used to model roadside noise levels from vehicle traffic along 11 road segments. Total peak-hour vehicle volumes used for the modeling were derived from VI.E. Transportation, Figure VI.E.3, p. VI.E.9. The traffic counts that generated those numbers were conducted by Barton-Aschman Associates in October and November of 1985. All trucks were assumed to be "heavy" trucks, a worst-case assumption. Truck percentages were taken from information provided by Barton-Aschman Associates. Vehicle speeds were also provided by Barton-Aschman, although the anticipated 25 mph vehicle speed within the Project Area, which was used in the Air Quality Analysis, was below the minimum speed of 31 mph allowed by the SNAP1 model. Barton-Aschman's suggested speed of 45 mph for I-280 traffic was used for traffic along that segment, but 31 mph was used within the Project Area. The effect of inflating the vehicle speed from 25 to 31 mph was to increase vehicle noise levels by about three dBA, and truck noise levels by about two dBA. The inflated vehicle speed, therefore, provides a worst-case estimate of Project Area traffic noise levels. The noise modeling did not take into account the possibility that some portions of the Project Area would be shielded from traffic on major thoroughfares by buildings and other structures, which can reduce noise from a line source such as a road by about eight to ten decibels. Further information regarding the noise modeling is provided in Appendix G. p. XIV.G.3.

/7/ U.S. Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, Report #550/9-74-004, March 1974.

IMPACT

/8/ Noise levels above 75 dBA, L_{eq} have been shown to interfere with 100% of normal conversation when the speakers are within two meters (about six feet) of each other. The following table (Jack Golden, et al., Environmental Impact Data Book, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan 1979 and U.S. Department of Housing and Urban Development, The Noise Guidebook, Washington, D.C., March 1985) shows other potential effects of noise levels on people:

Decibels (dBA)	Examples	Potential Effect/ Perceived Noise Level
0	Threshold of hearing	Very faint
10	Rustle of leaves in wind	Barely audible
20	Average whisper/broadcast studio	Very faint
30	Average residence without stereo playing	Faint - slight sleep interference
40	Soft radio music in apartment, refrigerator, light traffic at 100 feet	Faint - moderate

(continued)

Decibels (dBA)	Examples	Potential Effect/ Perceived Noise Level
50	Average office, Quiet conversation at 10 feet	Moderate
60	Normal speech level, air conditioner	Moderate - loud
65	Urban residential, electric typewriter at 10 feet	Loud - communication interference annoyance threshold
70	Vacuum cleaner, Average traffic at 100 feet	Smooth muscles/glands react
75	Office with tabulating machines	Changed motor coordination
80	Freeway traffic at 50 feet, garbage disposal	Moderate hearing damage (continuous exposure)
85	Construction/noisy city	Very annoying
90	Propeller plane flyover at 1,000 feet, food blender, diesel truck at 25 feet	Prolonged exposure affects mental and motor behavior
95	Freight train at 50 feet	Severe hearing damage after four hours per day exposure for extended periods
100	Loud auto horn at 10 feet	Very loud, hearing damage after two hours per day exposure for extended periods
110	Accelerating motorcycle at 20 feet	Hearing damage after one-half hour per day exposure for extended periods
115	Maximum vocal effort, discotheque	Deafening
125	Jet take off at 200 feet	Pain threshold

/9/ The reductions of exterior noise levels achieved by the specific building types (FHWA Policy and Procedures Memorandum 90-2, February 8, 1973) are shown below.

Building Type	Window Condition	Reduction of Exterior Noise Achieved by Building Type
All	Open	10 dB
Light Frame (houseboats, wood frame)	Ordinary sash, closed	20 dB
Concrete	Single pane, closed	25 dB
Concrete	Double pane, closed	35 dB

/10/ The evening peak hour typically occurs between 4:30 and 5:30 p.m. on weekdays.

/11/ Complete listings of the computer input and output are available for public review at the Department of City Planning, Office of Environmental Review, 450 McAllister Street.

/12/ Barton-Aschman Associates, Inc., "Mission Bay EIR Vehicle Demand Analysis," August 3, 1987, on file at the Department of City Planning, Office of Environmental Review.

/13/ Although a noise technician was not present during measurement of the 103 dBA, L_{eq} value, this probably was an instantaneous event associated with freight loading or unloading.

/14/ San Francisco, Department of City Planning, "Noise/Buffering: Mission Bay, San Francisco", Special Study for Mission Bay, September 4, 1986.

/15/ San Francisco Department of City Planning, Plan for Transportation Noise Control, Environmental Protection Element of the Master Plan, adopted by the City Planning Commission, Resolution 7244, September 19, 1974.

H. ENERGY

SETTING

LOCAL ENERGY SUPPLY AND DISTRIBUTION

Mission Bay is within the service area of Pacific Gas and Electric Company (PG&E). PG&E's service area covers 94,000 square miles in northern and central California, includes 48 of California's 58 counties, and has a population of more than ten million people. PG&E produces electricity from both renewable and non-renewable resources. PG&E also plans to rely on customer-owned generation (e.g., cogeneration), increased geothermal resources, and continued purchase of surplus hydroelectric power from the Pacific Northwest./1/ PG&E obtains natural gas from Alberta, Canada, Texas and California.

Electricity

San Francisco obtains electricity from PG&E and from the municipally owned and operated Hetch Hetchy Water and Power system. PG&E supplies electricity to private residential, commercial and industrial customers, while Hetch Hetchy provides power primarily for municipal operations.

Pacific Gas and Electric Company

Electricity is generated within San Francisco by two local gas-fired power plants, Hunters Point and Potrero, with a total capacity of about 792 Megawatts (MW)./2/ Interties with other portions of PG&E's service area and other utilities in the state enable the city to receive power from plants outside of San Francisco. The 23rd and Illinois Street (Potrero) substation distributes electricity to five above-ground and ten underground power lines that serve the Project Area and its vicinity./3/ The Potrero substation has a capacity of 134.3 MW. PG&E plans, in the future, to serve portions of the Project Area and vicinity from its 74.5 MW - capacity Embarcadero Station at Folsom and Fremont Streets.

PG&E's total electrical capacity is about 16,600 MW, consisting of about 42% oil- or gas-fired plants; about 15% hydroelectric; about 19% nuclear; about 8% geothermal; about 7% pumped storage; and about 9% cogeneration, other sources, and purchases from other utilities./4,5/ The Diablo Canyon nuclear power plant provides about 70% of

PG&E's nuclear capacity; Unit One began supplying commercial power in May 1985 and Unit Two began operation in March 1986./5/ Helms Pumped Storage Hydroelectric Project, which began operation in December 1983, and San Luis Reservoir provide the pumped-storage hydroelectric component of PG&E's system./4,6/ PG&E purchases some electricity from other utilities, mostly inexpensive surplus hydroelectric power from Washington and Oregon. PG&E will continue purchasing surplus hydroelectric power as long as it is available and inexpensive./4/ By 1996, according to forecasts prepared by the California Energy Commission (CEC), PG&E will need an additional 3,200 MW of capacity; load management will become an important consideration in minimizing peak demand for electricity./7/

Hetch Hetchy Water and Power

Hetch Hetchy Water and Power, a municipally owned water and electric system, is operated by the City and County of San Francisco under provisions of the Raker Act (38 Stats. 242, 1913). While recognizing certain pre-existing rights of the Modesto and Turlock Irrigation Districts, the Raker Act established the rights of San Francisco to obtain both water and power from the Tuolumne River.

The Hetch Hetchy system generates electricity from three hydroelectric facilities on Tuolumne River and Cherry Creek in the Sierra Nevada. Total Hetch Hetchy capacity is 339 MW, generated by the Moccasin Powerhouse (104 MW), Holm Powerhouse (150 MW) and Kirkwood Powerhouse (85 MW)./8/ San Francisco receives Hetch Hetchy power via the PG&E transmission and distribution system.

Approximately 95% of the power generated by Hetch Hetchy is consumed by the City and the Modesto and Turlock Irrigation Districts, with about one-third of this going to the City (including San Francisco International Airport and its tenants, the largest municipal consumer) and about two-thirds going to the Modesto and Turlock Irrigation Districts./8/ The remaining 5% is sold to miscellaneous "assigned" industrial customers.

Natural Gas

PG&E distributes natural gas to San Francisco from one gas storage tank on Pennsylvania Avenue about one-quarter mile south of the Project Area. This tank is scheduled to be dismantled after 1989, when PG&E's program of upgrading the capacity of the gas transmission lines supplying San Francisco will preclude the necessity for natural-gas storage within the City./9/ PG&E purchases, rather than produces, most of its natural gas. Its policy is to purchase first from non-California sources./1/ This policy, which helps preserve California's natural gas in case of shortages, will continue as long as it is economical. PG&E receives about 39% of its natural gas from Canada, about 39% from the southwestern United States and about 22% from California./4,5/

Steam

PG&E's only district steam heating system consists of natural-gas-fired boilers at two facilities, Stations S and T, and steam distribution lines serving portions of the C-3 District./10,11/ Station S, built in 1913 at Sutter and Hyde Streets, has a capacity of 130,000 pounds (lb.) of steam per hour and 2.8 miles of low-pressure distribution lines. Station T, built in 1924 at Sixth and Jessie Streets, has a capacity of 360,000 lb. of steam per hour and 9.9 miles of high-pressure distribution lines. The steam system supplies about one billion Btu of steam heat per year to about 280 commercial customers. Located about 0.75 miles from the Project Area, the steam system is being upgraded and expanded.

Liquid Fuels

Private vehicles and public transit serving the Project Area, such as buses and CalTrain, purchase gasoline and diesel fuel from a variety of distributors in the San Francisco area.

ENERGY DEMAND AND CONSUMPTION

Electricity

Commercial and industrial uses in the Project Area currently consume an estimated 11.6 million kilowatt-hours (kWh) of electricity, or about 119 billion Btu, per year./12,13,14/ Assumptions upon which this estimate is based are shown in Appendix H. Energy, Table XIV.H.1, p. XIV.H.1. Most of this energy is used for industrial applications, including lighting and operation of power equipment for the production, maintenance, storage, and repair of goods and equipment. Some energy is consumed for commercial and office purposes; these uses consist primarily of lighting, heating, air conditioning, and computer operations. Electricity demand in the Project Area and vicinity peaks at about 10.3 MW, or about 7.6% of the capacity of the Potrero Substation./4/ Peak demand typically occurs in summer, at about 12:00 noon.

Citywide consumption of electricity is about 3.8 billion kWh annually./15/ Peak demand for electricity is about 785 MW./2/ Citywide electrical demand had historically peaked in winter, whereas PG&E's system-wide demand usually peaks in summer./10/ In the 1970s, however, citywide summer demand increased more rapidly than winter demand, probably due to the large amount of commercial development, combined with conversion of residential space heating from electrical to natural gas./10/ Citywide demand now usually peaks in August or September, coincident with system-wide demand, when temperatures are the warmest./15/ In 1985, peak demand generally occurred from noon until 2:00 p.m. in October, due to unseasonably warm weather.

Electricity provides about 57% of the energy consumed in the PG&E service area. Consumption increased at about 2% per year between 1975 and 1985, and is currently about 64.7 billion kWh./5/ Peak demand, which determines PG&E's generation and distribution capacity, is about 16,500 MW; PG&E's reserve margin is about 8% of peak demand./4,5,16/ A reserve margin of 5% or less triggers statewide energy emergency plans./7/

Natural Gas

Natural gas use in the Project Area is about 37 million cubic feet, or about 41 billion Btu, per year./14/ Assumptions upon which this estimate is based are shown in Appendix H. Table XIV.H.1, p. XIV.H.1.

About 35 billion cubic feet of natural gas are consumed in the City annually. Peak daily demand is about 292 million cubic feet, about 8% of the service area demand./2/ In 1985, the peak day was Friday, December 27./2,4/ Peak-hour demand was 17 million cubic feet and occurred from 9:00 to 10:00 a.m. on December 27. Natural gas is used primarily for space and water heating, although the amount used for air conditioning is increasing./10/ Consumption of natural gas in the PG&E service area is about 492 billion cubic feet per year./4/ Peak demand in the service area, which normally occurs in January, is about 3.7 billion cubic feet per day./15/

Transportation Energy

In 1985, automobiles provided about 53 million vehicle-miles per year of travel between the Project Area and outlying areas, using about 2.8 million gallons of gasoline and about

100,000 gallons of diesel./17/ The overall source energy requirement of about 420 billion Btu annually to provide about 71 million passenger-miles of travel is about 5,900 Btu per passenger mile.

ALTERNATIVE ENERGY RESOURCES

The potential exists in the Project Area and vicinity for developing alternative, or unconventional, power sources such as district heating and cooling, cogeneration or solar energy collection systems. District heating and cooling, which would provide thermal energy to residential and commercial buildings from a central plant, cogeneration, passive solar design, and daylighting could reduce energy use in appropriately designed structures. The energy conservation potential in the Project Area is a resource that will be affected by future development.

ENERGY CONSERVATION POLICIES, REGULATIONS AND ORDINANCES

Rising energy costs and energy shortages have led to general concern for energy conservation. At the state level, Title 24 of the California Administrative Code regulates the energy efficiency of buildings and Title 20 regulates the energy efficiency of appliances. California's Solar Rights Act, which added Section 66473.1 to the State Subdivision Map Act, requires that subdivision designs provide, to the extent feasible, for future passive or natural heating or cooling opportunities. At the local level, elements of the City's Master Plan, the City Administrative Code, and related policies establish energy conservation measures.

The Energy Component of the Environmental Protection Element of the Master Plan is the basis for local energy management, providing a general policy framework to direct both public and private decisions on energy use. Specific energy conservation measures for the city were developed by the Citizens' Energy Policy Action Committee (CEPAC), appointed by the Mayor in 1981 to study energy problems and to recommend energy conservation measures. CEPAC's final report was adopted as the local energy conservation action program. An energy management committee, composed of representatives from the public and private sectors, was established to carry out the recommendations of CEPAC for the commercial sector. A district-heating committee has been established to provide recommendations on both PG&E and municipal heating systems.

New buildings in San Francisco must comply with Title 24 through either its prescriptive or its performance standards. Prescriptive standards ensure energy efficiency through required building design features. Performance standards are allowable annual energy budgets which, if met, exempt a building from some prescriptive requirements. The State Title 24 regulations are enforced in San Francisco by the Department of Public Works, Bureau of Building Inspection, through the building permit review process.

IMPACT

CONSTRUCTION ENERGY

Construction of buildings and infrastructure would require both direct and indirect expenditures of energy. Direct energy is directly consumed by an activity. For example, the refined petroleum products needed to operate construction equipment would be a direct energy expenditure. Indirect energy is consumed through sectors that provide inputs to an activity, rather than energy consumed by the activity itself. For example, the use of a steel beam in construction indirectly represents energy consumed in all of the industries that contributed to the production of the beam (e.g., energy consumed through mining and extraction of raw materials, manufacturing, and transportation). Indirect energy typically represents about three-quarters of total construction energy, while direct energy represents about one-quarter of total construction energy./18/ Total energy that would be consumed through new construction associated with each Alternative is shown in Appendix H., Energy, Tables XIV.H.2-XIV.H.4, pp. XIV.H.2-XIV.H.4.

2000

Alternative A

New construction associated with Alternative A would consume approximately 6,000 billion Btu of energy from 1986 through 2000./19/ That energy, representing both direct energy consumed on-site and indirect energy embodied in the various materials used, would be equivalent to the energy content of approximately one million barrels of crude oil.

Alternative B

Approximately 3,400 billion Btu of energy would be consumed in the construction of Alternative B through 2000./19/ That would be equivalent to about 590,000 barrels of crude oil.

Alternative N

Construction through 2000 would represent approximately 2,400 billion Btu, equivalent to about 410,000 barrels of crude oil./19/

Build-Out/2020

Alternative A

New construction associated with Alternative A between 2001 and 2020 would consume about 9,600 billion Btu of energy, for a total of about 15,600 billion Btu expended by build-out./19/ That energy expenditure would be equivalent to approximately 1.7 million barrels of crude oil between 2001 and 2020, and a total of 2.7 million barrels of crude oil for project build-out.

Alternative B

Construction of Alternative B would require about 5,100 billion Btu of energy from 2001 through 2020, and a total of 8,500 billion Btu by build-out./19/ That energy expenditure would be equivalent to approximately 880,000 barrels of crude oil for the period from 2001 through 2020, and a total of 1.5 million barrels of crude oil by build-out.

Alternative N

Construction associated with Alternative N for the period from 2001 through 2020 would consume approximately 5,500 billion Btu of energy, equivalent to about 950,000 barrels of crude oil./19/ Total construction energy consumption by 2020 would be about 7,900 billion Btu, equivalent to about 1.4 million barrels of crude oil./19/

OPERATIONAL ENERGY

New development in Mission Bay would increase electricity and natural gas consumption in the Project Area and contribute to increased energy consumption and demand in San Francisco and PG&E's service area. Most of the electricity in Mission Bay would be used for lighting and heating, ventilating, and air conditioning (HVAC). A lesser amount would be consumed by electrical appliances. In Mission Bay, natural gas would be used primarily for space and water heating.

The total energy that would be consumed, and the proportion that would be supplied by electricity or natural gas, would vary among Alternatives in relation to the amount and mix of proposed land uses. In commercial land uses, especially office and similar types of land uses such as service, light industrial, and research and development, electricity generally would supply a higher proportion of total energy consumption than natural gas. Conversely, in residential land uses, natural gas typically would represent a higher proportion of total energy consumption than electricity (assuming use of natural gas for space and water heating). On a per-square-foot basis, commercial land uses would consume more electricity than residential uses, while residential uses would consume more natural gas. In terms of total at-source energy, commercial land uses, with their higher electrical consumption, generally would consume more energy per square foot than would residential land uses. Estimates of Mission Bay energy consumption are based on average historical energy consumption, and do not explicitly account for any future major changes in energy consumption patterns.

2000

Table VI.H.1 summarizes projected annual operational energy consumption for Mission Bay for each Alternative for the year 2000.

Mission Bay energy consumption would represent a substantial increase in energy consumption in the Project Area (see Table VI.H.1). It would add to city-wide and regional energy consumption as well, although its contribution would be proportionally lower when viewed in a city-wide or regional context. San Francisco's cumulative operational electricity consumption in 2000 is expected to be about five billion kWh (51 trillion Btu) per year, an increase in annual electricity consumption between 1985 and 2000 of about 1.2 billion kWh (12 trillion Btu)./20/ Mission Bay electricity consumption would represent about 5% of that growth under Alternative A, and about 3% of that growth under Alternatives B and N. Electricity consumption in PG&E's service area is expected to increase by about 30 billion kWh (310 trillion Btu) between 1985 and 2000./21/ Project-related electricity consumption would represent about 0.2% of that growth under Alternative A, and about 0.1% of that growth under Alternatives B and N.

San Francisco's natural gas consumption is expected to remain at about 35 billion cubic feet (39 trillion Btu) per year from 1985 through 2000./20/ Mission Bay natural gas consumption would thus represent an increase of less than 1% in citywide consumption.

TABLE VI.H.1: ANNUAL PROJECT AREA OPERATIONAL ENERGY CONSUMPTION BY ALTERNATIVE, 1985 AND 2000/a/

Annual Energy Consumption	1985	2000 Alternative A	 Alternative B	 Alternative N
Electricity				
kWh (in millions)	12	62	32	40
Btu (in billions)	120	630	330	410
Natural Gas				
Cubic Feet (in millions)	37	230	170	82
Btu (in billions)	41	250	190	90
Total				
Btu (in billions)	160	880	520	500

NOTE: Totals may not add due to rounding (entries rounded to two significant digits).

/a/ Based on commercial energy consumption factors as adapted from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), residential energy consumption factors from the San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor areas contained in Table V.1, p. V.8 in Chapter V. The EIR Alternatives and Approval Process. See Appendix H. Tables XIV.H.5-XIV.H.7, pp. XIV.H.5-XIV.H.7, for calculations and consumption factors.

SOURCE: Environmental Science Associates, Inc.

Natural gas consumption in PG&E's service area is projected to increase by about 230 billion cubic feet (250 trillion Btu) per year from 1985 to 2000./22/ Project-related natural gas consumption would represent 0.1% or less of that increase in consumption under all Alternatives.

Alternative A

Annual operational energy consumption in 2000 under Alternative A would be about 62 million kWh (630 billion Btu) of electricity and about 230 million cubic feet (250 billion Btu) of natural gas./23/ The total annual operational energy consumption would represent an at-source energy content of about 880 billion Btu per year, equivalent to about 150,000 barrels of crude oil. Electricity consumption in the Project Area would be equivalent to about 1.6% of the electricity currently consumed in the City, and about 0.1% of the electricity currently consumed in the PG&E service area. It would represent about 5% and 0.2% of projected growth in electricity consumption in San Francisco and the PG&E service area, respectively, to the year 2000. Natural gas consumption would represent about 0.7% of existing consumption in the City, and less than 0.1% of existing consumption in the PG&E service area.

Alternative B

The land uses projected would consume about 32 million kWh (330 billion Btu) of electricity and about 170 million cubic feet (190 billion Btu) of natural gas annually./23/ The total annual operational energy consumption would be equal to about 520 billion at-source Btu per year, roughly equivalent to 90,000 barrels of crude oil. Annual Project Area electricity consumption in 2000 would be equivalent to about 0.8% of the electricity currently consumed in San Francisco, and less than 0.1% of the electricity currently consumed in the PG&E service area. It would be about 3% and 0.1% of projected growth in electricity consumption in the City and the PG&E service area, respectively. Natural gas consumption would be equivalent to about 0.5% of existing natural gas consumption in San Francisco, and less than 0.1% of existing consumption in the PG&E service area.

Alternative N

Annual operational energy consumption would be about 40 million kWh (410 billion Btu) of electricity and about 82 million cubic feet (90 billion Btu) of natural gas./23/ The total annual operational energy consumption would be equal to about 500 billion at-source Btu, equivalent to about 86,000 barrels of crude oil. Electricity consumed in 2000 would be equivalent to about 1.1% of the existing electricity consumption in San Francisco, and less than 0.1% of existing electricity consumption in the PG&E service area. It would be about 3% and 0.1% of City and service area growth in consumption. Natural gas consumption would be about 0.2% of existing natural gas consumption in the City, and less than 0.1% of existing natural gas consumption in the PG&E service area.

Build-Out/2020

Table VI.H.2 summarizes the projected annual operational energy consumption for each Alternative at build-out/2020. PG&E has not forecast energy consumption and demand for 2020./24/

TABLE VI.H.2: ANNUAL PROJECT AREA OPERATIONAL ENERGY CONSUMPTION BY ALTERNATIVE, 1985 AND BUILD-OUT/2020/a/

Annual Energy Consumption	1985	2020 Alternative A	2020 Alternative B	2020 Alternative N
Electricity				
kWh (in millions)	12	150	54	94
Btu (in billions)	120	1,500	550	960
Natural Gas				
Cubic Feet (in millions)	37	520	510	180
Btu (in billions)	41	570	560	200
Total				
Btu (in billions)	160	2,100	1,100	1,200

NOTE: Totals may not add due to rounding (entries rounded to two significant digits).

/a/ Based on commercial energy consumption factors as adapted from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), residential energy consumption factors from the San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor area projections contained in Chapter V. The EIR Alternatives and Approval Process. See Appendix H., Tables XIV.H.8-XIV.H.10, pp. XIV.H.8-XIV.H.10, for calculations and consumption factors.

SOURCE: Environmental Science Associates, Inc.

Alternative A

Annual operational energy consumption in 2020 under Alternative A would be about 150 million kWh (1,500 billion Btu) of electricity and about 520 million cubic feet (570 billion Btu) of natural gas./23/ The total annual operational energy consumption would be equivalent to about 2,100 billion at-source Btu, or about 360,000 barrels of crude oil. Electricity consumed annually at project build-out would be equivalent to about 3.9% of the electricity currently consumed in San Francisco, and 0.2% of the electricity currently consumed in the PG&E service area. Natural gas consumption would represent about 1.5% of existing consumption in the City, and about 0.1% of existing consumption in the PG&E service area.

Alternative B

Operational energy consumption in 2020 under Alternative B would be about 54 million kWh (550 billion Btu) of electricity and about 510 million cubic feet (560 billion Btu) of natural gas per year./23/ The total annual operational energy consumption would be equal to about 1,100 billion at-source Btu per year, or about 190,000 barrels of crude oil. Annual Project Area electricity consumption in 2020 would be equivalent to about 1.4% of the electricity currently consumed in the City, and about 0.1% of the electricity currently consumed in the PG&E service area. Natural gas consumption would be equivalent to about 1.5% of existing natural gas consumption in San Francisco and about 0.1% of existing consumption in the PG&E service area.

Alternative N

Annual operational energy consumption in 2020 under Alternative N would be about 94 million kWh (960 billion Btu) of electricity and about 180 million cubic feet (200 billion Btu) of natural gas./23/ The total annual operational energy consumption would be about 1,200 billion Btu annually, equivalent to about 210,000 barrels of crude oil. Electricity consumed under Alternative N in 2020 would be equivalent to about 2.5% of existing electricity consumption in San Francisco, and about 0.1% of existing electricity consumption in the PG&E service area. Natural gas consumption would be about 0.5% of existing natural gas consumption in the City, and less than 0.1% of existing natural gas consumption in the PG&E service area.

ENERGY CAPACITY AND INFRASTRUCTURE

Energy demand could be supplied conventionally (i.e., by utility-provided electricity and natural gas), or could be supplemented or totally supplied by alternative energy systems. For example, PG&E and the project sponsor have looked into the feasibility of a district heating and cooling system for the Project Area. That type of system could provide thermal energy to residential and commercial buildings from a more-efficient central plant. (Refer to p. VI.H.21 for a discussion of a district heating and cooling system.) Following is a discussion of Project Area impacts on energy capacity and infrastructure, should energy be supplied conventionally.

2000

Electricity

The most important factor in determining electrical supply and distribution requirements is electrical demand, as opposed to total electricity consumption. Electrical demand refers to the amount of electricity being consumed at any one time; peak demand is the maximum demand occurring over a specified period.

Peak annual electrical demand for each Alternative was estimated using the projected total annual electricity consumption and typical load factors for each land use./25/ Estimated peak electrical demand for each Alternative for 2000 is shown in Table VI.H.3.

TABLE VI.H.3: PEAK ELECTRICAL DEMAND BY ALTERNATIVE, 2000 AND BUILD-OUT/2020/a/ (Megawatts)

	2000			2020		
	Alternative			Alternative		
	A	B	N	A	B	N
Peak Electrical Demand	18	9	11	46	16	24

/a/ Based on estimated annual electricity consumption and typical load factors for each land use. See Appendix H. Tables XIV.H.11-XIV.H.12, pp. XIV.H.11-XIV.H.12, for calculations and load factors.

SOURCE: Environmental Science Associates, Inc.

As compared to PG&E's total existing electrical generating capacity, the peak electrical demand associated with all of the Alternatives would be about 0.1% or less, thus adding incrementally to PG&E's total system load, but having no noticeable effect on PG&E's capacity. Mission Bay peak electrical demand would represent about 0.3% of PG&E's projected 5,500-MW growth in demand between 1985 and 2000 under Alternative A./21/ Alternatives B and N would represent about 0.2% of that growth in demand. PG&E does not anticipate any electrical generating capacity constraints that would interfere with serving year 2000 electrical loads at Mission Bay./26/

The Project Area would be served by the existing Potrero Substation. Preliminary load analysis by PG&E indicates that improvements to the electrical distribution system would be required to meet projected electrical demands./26/ Those improvements would be identical for all Alternatives for the year 2000. PG&E would install three additional 12-kilovolt (kV) feeders (major distribution lines) from the Potrero Substation to the Project Area to serve the additional load. An additional transformer bank at the Potrero Substation could also be required.

Natural Gas

PG&E does not anticipate any constraints in the availability of natural gas to serve the Alternatives./26/ The Project Area is currently served by a low-pressure gas distribution system, but is surrounded by a high-pressure system. This high-pressure system would be expanded and extended to meet the additional natural gas load for all Alternatives.

Build-Out/2020

Electricity

Table VI.H.3, p. VI.H.14, shows estimated peak electrical loads for each Alternative in 2020. As compared to PG&E's total existing electrical generating capacity, the peak electrical demand associated with Mission Bay Alternatives at build-out would be about 0.3% of current generating capacity or less. The Alternatives would add incrementally to PG&E's total system load. PG&E does not anticipate any electrical generating capacity constraints that would interfere with serving year-2020 electrical loads at Mission Bay./26/

The Project Area would be served by the existing Potrero Substation. Improvements to the existing distribution system would be required to meet electrical demands./26/ The types of improvements required would be similar for all Alternatives for the year 2020, but would differ in magnitude. PG&E would install additional 12-kV feeders from the Potrero Substation to the Project Area to serve the additional load. Eight additional feeders would be required for Alternative A, four would be required for Alternative B, and five would be required for Alternative N. An additional transformer bank at the Potrero Substation could also be required.

Natural Gas

PG&E does not anticipate any constraints in the availability of natural gas to serve the project in 2020./26/ The existing high-pressure gas distribution system that surrounds the Project Area would be expanded and extended to meet the additional natural gas load for all Alternatives.

TRANSPORTATION ENERGY

The amount of transportation energy consumed by each Alternative would vary in relation to total amount of travel and mode of transportation. Public transit would be more energy-efficient per passenger-mile than transportation by private automobiles. In Alternatives A and B, approximately 40% of the trips to and from the Project Area would be made on public transit and the remaining 60% would be made via private automobile. In Alternative N, about 20% of the Project Area-related trips would be made on public transit and about 80% would be made by private automobile. The proportion of trips made via public and private transit used in this analysis is considered "worst-case." Should the proportion of trips made via public transit increase due to increased traffic congestion or other factors, transportation energy-efficiency would increase, with a corresponding decrease in transportation energy consumption.

2000

Table VI.H.4 summarizes the projected annual transportation energy consumption for each Alternative for the year 2000.

Alternative A

Annual transportation energy consumption in 2000 under Alternative A would be about 1,300 billion at-source Btu, equivalent to about 220,000 barrels of crude oil./27/ That energy would consist of about 5.4 million gallons of gasoline, 2.3 million gallons of diesel, and 20 million kWh of electricity. Transportation energy consumption would be about triple the existing transportation energy consumption in the Project Area.

Total passenger-miles traveled under Alternative A would be about 430 million miles per year. Average transportation energy consumption would be about 3,100 Btu per

TABLE VI.H.4: ANNUAL TRANSPORTATION ENERGY CONSUMPTION BY ALTERNATIVE, 1985 AND 2000/a/

Parameter	1985	2000 Alternative A	2000 Alternative B	2000 Alternative N
Annual Transportation Energy Consumption				
Gasoline (Gals., in thousands)	2,800	5,400	3,000	3,400
Diesel (Gals., in thousands)	100	2,300	1,200	910
Electricity (kWh, in thousands)	--	20,000	11,000	5,000
TOTAL (Btu, in billions)	420	1,300	710	670
Annul Passenger-Miles Traveled (in millions)	71	430	230	210
Transportation Energy Consumption (Btu/passenger-mile)	5,900	3,100	3,100	3,200

NOTE: Entries are rounded to two significant digits.

/a/ Based on estimates of project-related passenger and vehicle trips, modal splits, and geographic distribution of trips developed in the transportation analysis. See Appendix H. Tables XIV.H.13-XIV.H.15, pp. XIV.H.13-XIV.H.15, for transportation energy consumption factors and calculations.

SOURCE: Environmental Science Associates, Inc.

passenger-mile, a decrease of about 47% over existing conditions, due to projected increase in fuel-efficiency of automobiles and increase in mass transit use.

Alternative B

Transportation energy consumed under Alternative B would amount to about 710 billion Btu per year./27/ This would be equivalent to about 120,000 barrels of crude oil, an increase of about 70% over existing transportation energy consumption. This energy would be provided by about three million gallons of gasoline, 1.2 million gallons of diesel, and 11 million kWh of electricity.

About 230 million passenger-miles of travel per year would take place under Alternative B. Average transportation energy consumption would be about the same as Alternative A, a decrease of about 47% over existing conditions.

Alternative N

Annual transportation energy consumption in 2000 under Alternative N would be about 670 billion Btu, equivalent to about 120,000 barrels of crude oil./27/ This would be an increase of about 60% over existing transportation energy consumption. About 3.4 million gallons of gasoline, 910,000 gallons of diesel, and five million kWh of electricity would be consumed.

About 210 million passenger-miles of travel per year would take place under Alternative N, for an average transportation energy consumption of about 3,200 Btu per passenger mile, a decrease of about 46% over existing conditions. Transportation energy use under Alternative N would be slightly less efficient than under Alternatives A and B because of less use of mass transit in Alternative N.

Build-Out/2020

Table VI.H.5 summarizes the projected annual transportation energy consumption for Alternative for build-out/2020. Average transportation energy consumption for all Alternatives would be about 3,000 Btu per passenger-mile, a decrease of about 49% over existing conditions. Transportation energy efficiency would improve slightly between 2000 and 2020 due to the further increase in fuel-efficiency projected for automobiles.

Alternative A

Annual transportation energy consumption in 2020 under Alternative A would be about 2,700 billion Btu, equivalent to about 470,000 barrels of crude oil./27/ This energy would be provided by about 11 million gallons of gasoline, 4.8 million gallons of diesel, and 41 million kWh of electricity. Transportation energy consumption under Alternative A would be about six and one-half times existing transportation energy consumption in the Project Area. Alternative A would generate about 910 million passenger-miles of travel per year at build-out.

TABLE VI.H.5: ANNUAL TRANSPORTATION ENERGY CONSUMPTION BY ALTERNATIVE, BUILD-OUT/2020/a/

		2020		
	1985	Alternative		
Parameter		A	B	N
Annual Transportation Energy Consumption				
Gasoline (Gals., in thousands)	2,800	11,000	6,600	7,900
Diesel (Gals., in thousands)	100	4,800	2,600	2,200
Electricity (kWh, in thousands)	--	41,000	23,000	12,000
TOTAL (Btu, in billions)	420	2,700	1,600	1,600
Annual Passenger-Miles Traveled (in millions)	71	910	530	520
Transportation Energy Consumption (Btu/passenger-mile)	5,900	3,000	3,000	3,000

NOTE: Entries are rounded to two significant digits.

/a/ Based on estimates of project-related passenger and vehicle trips, modal splits, and geographic distribution of trips developed in the transportation analysis. See Appendix H. Tables XIV.H.16-XIV.H.18, pp. XIV.H.16-XIV.H.18, for transportation energy consumption factors and calculations.

SOURCE: Environmental Science Associates, Inc.

Alternative B

Transportation energy consumption in 2020 under Alternative B would be about 1,600 billion Btu per year./27/ That would be equal to about 280,000 barrels of crude oil, about four times existing consumption. This energy would consist of about 6.6 million gallons of gasoline, 2.6 million gallons of diesel, and 23 million kWh of electricity. Alternative B would generate about 530 million passenger-miles of travel per year at build-out.

Alternative N

Annual transportation energy consumption in 2020 under Alternative N would be about 1,600 billion Btu per year./27/ Transportation energy consumption under Alternative N would be equivalent to about 280,000 barrels of crude oil, about four times existing consumption. About 7.9 million gallons of gasoline, 2.2 million gallons of diesel, and 12 million kWh of electricity would be consumed. Alternative N would generate about 520 million passenger-miles of travel per year at build-out.

COMPLIANCE WITH ENERGY REGULATIONS AND OBJECTIVES

Buildings in Mission Bay would be required to comply with either the prescriptive or performance requirements of Title 24 Energy Conservation Standards. Compliance with Title 24 would be enforced by the San Francisco Department of Public Works, Bureau of Building Inspection, through the building permit review process. The sale and installation of appliances would be regulated by the Title 20 Appliance Efficiency Standards.

The Energy Component of the Environmental Protection Element of the City's Master Plan has established objectives to increase the efficiency with which energy is used locally in residences, commercial and industrial establishments, and transportation, and to promote the use of renewable energy sources. While there are no quantitative standards by which to judge compliance of Mission Bay with the Energy Component, the degree to which each Alternative implements energy conservation measures and exploits renewable energy sources would provide an informal measure of compliance. The higher the energy-efficiency of project layout and design, the better it will meet the City's energy objectives as outlined in the Energy Component of the Master Plan; however, it is not known at this time what types of energy conservation measures would be incorporated into the Alternatives (see Mitigation, p. VI.H.21).

MITIGATION

In addition to required compliance with energy-related regulations (Title 24 Energy Conservation Standards and Title 20 Appliance Efficiency Standards), Mission Bay energy consumption could be further reduced by other means. The following measures would increase energy efficiency, beyond that required by law, in conformance with the objectives and policies of the Energy Component of the Environmental Protection Element of the Master Plan.

Measure	Alternative	Description
H.1	A,B,N	Replace energy-intensive materials and construction methods with less-intensive ones, where feasible, to reduce construction energy consumption while maintaining the same final building performance criteria.
H.2	A,B,N	Consider energy consumption along with other factors in project design. Operational energy consumption could be reduced by a variety of measures. Possible energy-efficient measures are summarized below:/28/
H.2a		District Heating and Cooling System. A District Heating and Cooling (DHC) System could reduce the energy consumed in the generation of thermal energy (for space, water, or process heat) through the use of a more-efficient, centralized plant rather than individual heating units in each building. This measure is being investigated by PG&E and San Francisco Public Utilities Commission Bureau of Energy Conservation staff. A preliminary feasibility study by PG&E indicates that this option shows promise for high density development concentrated in localized portions of the Project Area, such as office and high density housing north of China Basin Channel in Alternative A. However, efficiencies of such a system would be affected by phasing of development and building design. As a result, further study would be warranted when additional details of the Mission Bay

Measure	Alternative	Description
		development become available. This is a "high-priority" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,29/
H.2b		Energy-Efficient Equipment and Appliances. Use of energy-efficient heating and cooling equipment and electric appliances could reduce operational energy consumption. This could be accomplished through the use of natural-gas-fired space and water-heating equipment, and energy-efficient electric appliances. This is a "high-priority" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,29/
H.2c		Reduced Lighting. Appropriate reductions in building lighting can conserve energy consumed by the lighting equipment itself, and additional air conditioning required to remove waste heat generated by the lights, while maintaining adequate light levels. Reduced-lighting strategies include targeting light levels to the task at hand (e.g., higher light levels in work areas and lower light levels in surrounding areas), use of more-efficient lighting equipment, automatic lighting controls (to turn off unneeded lights), and daylighting. A low-cost feasibility analysis for individual commercial buildings to determine energy and cost saving potential from utilizing daylighting could be required. This is a "high-priority" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,29/
H.2d		Operation and Maintenance Plans. Building system operation and maintenance plans could help to reduce operational energy consumption through more-efficient use and maintenance of building systems. Such plans could include information on all energy-consuming building systems, building-specific guidance on the most-efficient use of energy, and required maintenance. This measure would be most appropriate for non-residential buildings and large residential buildings. This is a "high-priority" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,29/

Measure	Alternative	Description
H.2e		Recycling and Conservation. Recycling of materials and conservation of water would have energy benefits in addition to decreasing the consumption of other natural resources. This is a "high-priority" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,29/
H.2f		Load Management. Load management strategies could be used to reduce the impact on electrical generating capacity. Energy loads could be reduced by "peak shaving" (the reduction of electrical demand during high utility use periods) and curtailable-load programs (in which participants receive financial incentives for shedding specified loads several times during the year). This is a "high-priority" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation. /28,29/
H.2g		Natural Cooling. Cooling loads could be reduced by taking advantage of San Francisco's year-round cool climate. Non-residential buildings could use outside-air economizers (which use cool outside air rather than energy-consuming refrigeration equipment for air conditioning) and, of course, residential buildings could use windows for natural ventilation. This is a "high-priority" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,29/
H.2h		Passive Solar Space-Heating. Passive solar space-heating uses design measures, rather than mechanical means, to collect and store solar energy. Passive solar design would be most appropriate for residential buildings, and could be considered in the overall context of design including construction costs, privacy, street orientation, and views. Solar energy could be collected directly in the living space and stored in the building materials. Passive solar design measures include building orientation (south-facing orientations are best), building use (locating the main living area on the south side of the building would maximize solar energy use), use of appropriate building

Measure	Alternative	Description
		materials to provide "thermal mass" to store thermal energy and moderate temperatures, optimizing glazing areas based on wall orientation, and use of suitable types and placement of landscaping. This is a "high-marketability" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,30/
H.2i		Energy Management and Control Systems. Computerized energy management and control systems can provide optimum control of energy-consuming equipment. These systems are most appropriate for relatively large (greater than 100,000 square feet) non-residential buildings. This is a "high-marketability" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,30/
H.2j		Individual Metering. Individual metering of electricity and natural gas use provides an incentive for tenants to use energy wisely. This would be an appropriate strategy for multi-family residential buildings. Individual metering (by tenant or by floor) could also be appropriate for multiple-tenant, non-residential buildings. This is a "high-marketability" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,30/
H.2k		Cogeneration. Cogeneration is the combined production of thermal energy and electricity. The thermal energy is typically used for on-site space, water, or process energy and the electricity is either used on-site or sold to a utility. Cogeneration is particularly well-suited to buildings with large thermal loads, and could be appropriate for large residential buildings (200 or more units), large non-residential buildings (greater than 300,000 square feet), light industries with process heat requirements, and the hotel. This is a "high-marketability" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,30/

Measure	Alternative	Description
H.2l		Landscaping and Building Orientation for Wind. Wind can increase the energy consumption of buildings through infiltration and cooling of the building surface. Buildings could be oriented with their long axes parallel to the prevailing winds (generally from the west and northwest in San Francisco), with landscaping on the west and northwest sides. These measures would reduce energy loss through wind while still providing adequate solar access, but could impose tradeoffs against other objectives such as siting and design of land uses, and land use efficiency. This is a "high-marketability" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,30/
H.2m		Optimized Glazing. Optimized glazing is the most energy-efficient combination of glass characteristics in a building. Factors which affect energy consumption include the amount (percentage) of glass, the daylight penetration, and the shading coefficient. Optimized glazing would be most appropriate for non-residential buildings. This is a "high-affordability" measure as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,31/
H.2n		Photovoltaics. While these semiconductor devices which produce electricity directly from sunlight are not currently economically feasible, their use could become cost-effective prior to project build-out. To accommodate possible future use of photovoltaics, solar access to building rooftops and flat or south-facing roofs should be considered in building design. Photovoltaics could have minor adverse visual impacts on views from surrounding areas. This is a measure that would prepare for future advances in technology, as defined by the San Francisco Public Utilities Commission, Bureau of Energy Conservation./28,32/
H.3	A,B,N	Reduce transportation energy consumption by measures which reduce the vehicle miles traveled and encourage the use of mass transit. Address these types of measures in a Transportation System Management (TSM) Plan.

NOTES

SETTING

/1/ Gerald Tyson, Marketing Supervisor, Pacific Gas and Electric Company (PG&E), telephone conversation, February 3, 1986.

/2/ John C. Brisky, PG&E, letter to ESA, October 16, 1986.

/3/ Edward Guerrero, Division Operator Supervisor-San Francisco, PG&E, telephone conversation, February 3, 1986.

/4/ John C. Brisky, PG&E, letter to ESA, August 27, 1986.

/5/ Pacific Gas and Electric Company, Annual Report, 1985.

/6/ Pumped-storage hydroelectric systems provide a means for the large-scale storage of energy. Excess electricity produced during periods of low electrical demand is used to pump water into an elevated reservoir. During periods of high electrical demand, the water is released to operate a hydroelectric generator.

/7/ California Energy Commission, The 1985 California Electricity Report, 1985.

/8/ Lawrence Kline, Deputy General Manager, Hetch Hetchy Water and Power Department, telephone conversation, June 29, 1987.

/9/ William Healy, Gas Plant Foreman, PG&E; telephone conversation, February 3, 1986.

/10/ San Francisco Department of City Planning, Energy Supply and Consumption Patterns: Trends and Prospects, 1975 - 1985, 1980.

/11/ A district steam heating system provides residential or commercial space heating for a neighborhood from a central plant.

/12/ One kilowatt-hour (kWh) is the basic unit of electric energy, equal to a demand of one kilowatt of power supplied steadily for one hour.

/13/ British thermal units (Btu) are units of heat energy. One Btu is the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at sea level. All forms of energy can be converted to heat energy. Btu values given in this report are "at-source" values, which means that energy used in producing and transporting the various types of energy is included as well as the actual energy content. For example, the at-source energy value of electricity includes losses in energy that occur during the generation and transmission of electricity, and the at-source energy value of gasoline includes energy consumed through extraction, refining, and transportation of the fuel. The at-source energy contents of various forms of energy used herein are as follows: electricity, one kWh = 10,239 Btu (California Energy Commission, Building Energy Efficiency Standards, 1987); natural gas, one cubic foot = 1,100 Btu (Interactive Resources, Inc., Energy Conservation: Guidelines for Evaluating New Development in Contra Costa County, California, 1976); gasoline, one gallon = 143,700 Btu (Caltrans, Energy and Transportation Systems, 1983); and diesel fuel, one gallon = 147,600 Btu (Caltrans, Energy and Transportation Systems, 1983).

/14/ This estimate is based on information on existing land uses (floor areas by use and total employees) contained in Chapter V. The EIR Alternatives and Approval Process. See Appendix H for annual energy consumption factors and calculations.

/15/ San Francisco Department of City Planning, EE81.3, Downtown Plan EIR, certified October 18, 1984.

/16/ Reserve Margin is the difference between the net system generating capacity at a given time, including down-time for maintenance, and the system's maximum load (demand) requirements, including net scheduled transfer with other utilities, expressed as a percentage of the maximum demand.

/17/ Estimates of existing transportation energy consumption were based on estimates of the number and geographic distribution of passenger- and vehicle-trips developed for the Transportation analysis. Consumption factors for automobiles are from Caltrans, Energy and Transportation Systems, 1983. Existing use of mass transit in the Project Area is negligible.

IMPACT

/18/ Hannon, B., et al., 1978, "Energy and Labor in the Construction Sector," Science 202:837-847.

/19/ Based on construction energy consumption factors contained in Hannon, B., et al., floor area projections contained in V. The EIR Alternatives, and Infrastructure Construction Energy Data from Interactive Resources, Inc., Energy Conservation: Guidelines for Evaluating New Development in Contra Costa County, California, 1976. See Appendix H. Energy, Tables XIV.H.2-XIV.H.4, pp. XIV.H.2-XIV.H.4, for calculations and consumption factors.

/20/ San Francisco Department of City Planning, Downtown Plan EIR, 1984.

/21/ Pacific Gas and Electric Company, Forecast of the Demand for Electricity within the Pacific Gas and Electric Company Service Area 1987-2007, June 1987.

/22/ California Gas and Electric Utilities, 1987 California Gas Report, September 1987.

/23/ Based on commercial energy consumption factors from the California Energy Commission (Hoang Dang Nguyen, Research Economist, April 24, 1987), residential energy consumption factors from San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor area projections contained in V. The EIR Alternatives and Approval Process. See Appendix H. Energy, Tables XIV.H.5-XIV.H.10, pp. XIV.5-XIV.H.10 for calculations and consumption factors.

/24/ PG&E has forecast electrical consumption and demand in its service area for 2007. (Pacific Gas and Electric Company, Forecast of the Demand for Electricity within the Pacific Gas and Electric Company Service Area 1987-2007, June 1987.) PG&E projects an increase of 53 billion kWh per year in consumption, and about 10,000 MW in demand, from 1985 to 2007. Project-related electricity consumption in 2020 would represent about 0.3% of the 1985-2007 increase in consumption in PG&E's service area under Alternative A, about 0.1% under Alternative B, and about 0.2% under Alternative N. Project-related electrical demand would represent about 0.5%

of PG&E's 1985-2007 growth in demand under Alternative A, and about 0.2% under Alternatives B and N. PG&E has forecast natural gas consumption in its service area for 2005. (California Gas and Electric Utilities, 1987 California Gas Report, September 1987.) PG&E projects an increase in natural gas consumption of about 248 billion cubic feet per year from 1985 to 2005. Natural gas consumption under Alternatives A and B in 2020 would represent about 0.2% of PG&E's 1985-2005 growth in natural gas consumption; natural gas consumption under Alternative N in 2020 would represent less than 0.1% of PG&E's 1985-2005 growth in natural gas consumption.

/25/ A load factor is the ratio of average electrical demand to peak electrical demand over a specified period.

/26/ Dirk van Ulden, Marketing Manager, PG&E, letter, September 22, 1987. Based on estimates of energy consumption and demand provided by Environmental Science Associates, Inc.

/27/ Based on estimates of project-related passenger- and vehicle-trips, modal splits, and geographic distribution of trips developed in the transportation analysis. See Appendix H, Energy, Tables XIV.H.13-XIV.H.18, pp. XIV.H.13-XIV.H.18, for transportation energy consumption factors and calculations.

/28/ San Francisco Public Utilities Commission, Bureau of Energy Conservation, An Energy Plan for Mission Bay, Proposed Energy Efficiency Recommendations at the Mission Bay Project, Draft, 1987. The mitigation measures listed in H.2, p. VI.H.21, are summarized from the proposed Energy Plan.

/29/ High-priority measures include those that would provide the greatest benefit to Mission Bay residents and businesses in terms of energy and monetary savings. They also have the broadest base of support within the technical community and embody the characteristics of both marketability and affordability.

/30/ High-marketability measures are those that would contribute to the attractiveness (marketability) of Mission Bay while also reducing energy consumption and costs. Energy-conscious design principles could add to the amenity of the living environment by providing good light, fresh air, and comfortable living conditions.

/31/ High-affordability measures are those where the primary benefits are reduced energy costs. These measures may sometimes reduce initial cost as well.

/32/ Measures that prepare for future advances in technology include solar technologies such as photovoltaics that at present are not cost-effective sources of energy production, but will likely become increasingly available during the construction period of Mission Bay. These measures present design methods that will allow the implementation of alternative technologies in the future.

I. ARCHITECTURAL RESOURCES AND URBAN DESIGN

SETTING

ARCHITECTURAL RESOURCES

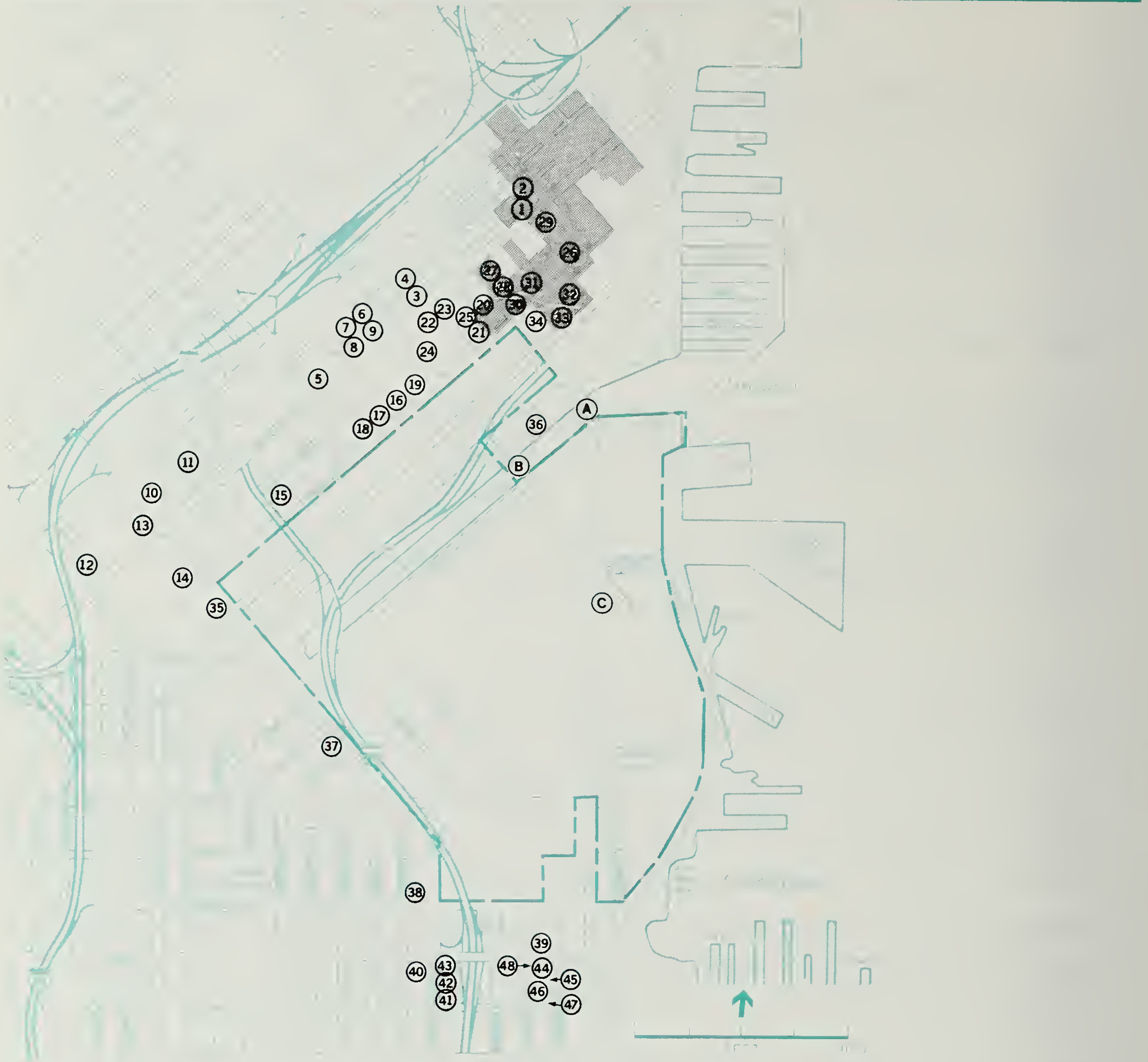
Architectural Surveys in San Francisco

The San Francisco Department of City Planning conducted a citywide inventory of architecturally significant buildings from 1974 to 1976, with numerical ratings from a low of "0" to a high of "5"./1/ The DCP survey listed no buildings within the Mission Bay Project Area. Within 1,000 feet of the project boundaries, 33 buildings are rated (see Figure VI.I.1, and Table VI.I.1, p. VI.I.3)./2/ Of these, the survey rated 28 buildings "0," "1" or "2," four rated "3," one was rated "4," and none "5."

The Foundation for San Francisco's Architectural Heritage (Heritage) has undertaken architectural surveys of South of Market areas, including Rincon Hill, Rincon Point, South Beach, Showplace Square, Mission Bay and the piers north of China Basin Channel. Within 1,000 feet of the project boundary, Heritage identified 22 structures as architecturally significant (see Figure VI.I.1 and Table VI.I.1)./3/ Other nearby areas had not been surveyed, such as the Port of San Francisco area near China Basin Street, and areas south of Mariposa Street. The northern portion of Potrero Hill, south of the Mission Bay Project Area, has been surveyed; the findings have not been published when this EIR was prepared.

Heritage has proposed that the Second and Townsend Streets area (outside the Mission Bay Project Area) be designated a historic district but has not defined a specific boundary for such a district, and is also considering proposing the four blocks that surround Bluxome Street, bounded by Fourth, Townsend, Sixth, and Brannan, adjacent to the Project Area, for historic district status (see Figure VI.I.1).

A 1983 historic architecture report for the I-280 Transfer Concept Study prepared by Caltrans identified two structures and proposed a South End Historic District near the Project Area at Second and Townsend as eligible or potentially eligible for listing on the National Register of Historic Places/4/ (see Figure VI.I.1 and Table VI.I.1). No further action listing those resources has been taken./5/



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— — —	MISSION BAY BOUNDARY
Ⓐ	LEFTY O'DOUL BRIDGE
Ⓑ	PETER MALONEY BRIDGE
Ⓒ	CLOSED FIRE STATION 30
① - ㊽	See Table VI.I.1 for building key.
▨	PROPOSED SOUTH END HISTORIC DISTRICT

Mission Bay

SOURCE: Environmental Science Associates, Inc.

FIGURE VI.I.1
ARCHITECTURAL RESOURCES
WITHIN PROJECT AREA AND VICINITY

TABLE VI.I.1: ARCHITECTURAL RESOURCES IN PROJECT VICINITY/a/

	Address	DCP Rating	On Heritage List
1.	300-310 Brannan	NR	Yes
2.	1 South Park	NR	Yes
3.	444 Brannan	1	No
4.	72 Freelon	2	No
5.	590 Brannan	1	No
6.	132-134 Freelon	0	No
7.	142-152 Freelon	0	No
8.	119 Freelon	0	No
9.	105 Freelon	1	No
10.	567 Seventh	3	No
11.	55-57 Boardman	1	No
12.	555-599 Eighth	2	Yes
13.	572 Seventh	2	No
14.	650 Seventh	NR	Yes
15.	665 Sixth	NR	Yes
16.	310 Townsend	2	Yes
17.	334 Townsend	3	No
18.	340-360 Townsend	3	Yes
19.	690 Fourth	0	No
20.	660-674 Third	1	Yes
21.	224 Townsend	1	No
22.	475-477 Brannan	1	Yes
23.	435 Brannan	2	No
24.	601-631 Fourth	NR	Yes
25.	322-326 Ritch	NR	Yes
26.	698 Second	NR	Yes
27.	625 Third	NR	Yes
28.	665 Third	NR	Yes
29.	301 Brannan	NR	Yes
30.	180 Townsend	NR	Yes
31.	178 Townsend	NR	Yes
32.	115-131 Townsend/b/	NR	Yes
33.	128 King/b/	NR	Yes
34.	135 Townsend	NR	Yes
35.	700-768 Seventh	3	Yes
36.	China Basin Building	1	Yes
37.	1200 Seventh	2	No
38.	199 Mississippi	1	No
39.	694 Tennessee	1	No
40.	300 Pennsylvania	4	No
41.	367 Pennsylvania	0	No
42.	331 Pennsylvania	2	No
43.	301 Pennsylvania	2	No
44.	700 Tennessee	1	No
45.	704 Tennessee	1	No

(continued)

TABLE VI.I.1: ARCHITECTURAL RESOURCES IN PROJECT VICINITY/a/ (continued)

	Address	DCP Rating	On Heritage List
46.	724-726 Tennessee	1	No
47.	732 Tennessee	1	No
48.	707 Eighteenth	0	No
A.	Lefty O'Doul Bridge	NR	No
B.	Peter Maloney Bridge	NR	No
C.	Closed Fire Station 30	NR	No

DCP - Department of City Planning.
Heritage - Foundation for San Francisco's Architectural Heritage.
NR - Not rated.

/a/ Numbered and lettered buildings and bridges are shown on Figure VI.1.1, p. VI.I.2.
/b/ Identified in I-280 Transfer Concept Study as potentially eligible for the National Register of Historic Places.

SOURCE: Department of City Planning; Foundation for San Francisco's Architectural Heritage; Royer Owen Boyer & Associates; and Environmental Science Associates, Inc.

Architectural Resources in the Mission Bay Project Area

Few existing buildings within the Mission Bay Project Area have been noted by historic or architectural surveys as important architectural resources. Closed Fire Station 30, at Third, Fourth and Mission Rock Streets in the Project Area (see Figure VI.I.1, p. VI.1.2) is not rated in the DCP or Heritage surveys. Constructed of red brick masonry in the Mission style, the two-story building has a Spanish tile roof surmounted by a low tower. The brick and masonry materials are sensitively designed and detailed. The building has a rear yard with an intricately detailed metal entrance gate flanked by two brick piers.

Historic and Architectural Resources in the Vicinity

The two China Basin Channel bridges, the Lefty O'Doul drawbridge at Third Street and the Peter J. Maloney drawbridge at Fourth Street are unique engineering structures. Both bridges have steel truss work and counterbalance structures. Evaluations of the historic significance of the bridges have concluded that both are eligible for listing on the National Register of Historic Places (see VI.J. Cultural Resources, p. VI.J.12).

Between the two bridges, adjacent to the Project Area, is the China Basin Building, listed in the DCP and Heritage Surveys. Constructed in 1921, the six-story former warehouse fronts the channel from Third to Fourth Street. Many of the buildings listed by Heritage, adjacent to the Mission Bay Project Area along Townsend or Seventh Streets, are former brick industrial or warehouse structures that have been converted to office or showroom uses. These buildings typically include brick work with decorative cornice and window details with masonry accents (see listings nos. 15-19, on Figure VI.1.1 and Table VI.1.1). The Baker Hamilton Design Center, formerly the Baker Hamilton Company's hardware and steel product warehouse at 700-768 Seventh Street, built in 1904 by Albert Pissis (listing no. 35), is a notable example of such brick and masonry design in the Showplace Square area./3/ The Baker Hamilton sign on the building's roof is visible from U.S. 101 to the west.

VISUAL QUALITY

Views from Potrero Hill

The Mission Bay Project Area, reflecting its history as filled land, is a relatively level area where visual landmarks are primarily low-rise buildings and other man-made structures. They contrast with surrounding high elements, such as Potrero Hill to the south, high-rise buildings in the financial district to the north, and I-280 wrapping around the west and north sides of the Project Area.

Figure VI.I.2, pp. VI.I.8-VI.1.9, is a panoramic view of the Mission Bay site from Potrero Hill southwest of the site. The prominent site characteristics include railroad tracks and the CalTrain station; one-story warehouses and light-industrial buildings; and elevated freeway structures. China Basin Channel, which extends across the site from Seventh Street to China Basin, divides the Project Area. Figure VI.1.2 also includes a reference key to the skyline view and an outline of the Project Area boundaries./6/

The elevated I-280 freeway visually defines the southwesterly boundary of the site. The freeway varies in height from 45 to 75 feet above ground and in some areas is up to 200 feet wide. At China Basin Channel near Seventh Street, the freeway turns northeast across the Project Area and parallels the north side of the channel with an exit ramp at Fourth Street. The remaining, unused "stub" of the elevated freeway continues to, and ends at, Third Street.

China Basin Channel, the last open water area of what was once Mission Bay, is a visual landmark for the northerly part of the site. Beginning near Seventh Street, at the Channel Street Pump Station, the channel flows under the Sixth Street I-280 ramp, and the Fourth and Third Street drawbridges, to China Basin and San Francisco Bay. The channel varies in width from 180 to 280 feet over its 4000-foot length.

North and northeast, adjacent to the site, are one- to five-story industrial and office buildings along Townsend Street (the northwesterly boundary of the Project Area) and along Third Street between Townsend and China Basin Channel. Beyond these buildings, the heights of buildings gradually step up to the high-rise buildings of the financial district, which range up to 52 stories. Figure VI.I.2 shows high-rise buildings in the First Street-Market-Mission area. North of the site are other landmarks: the Union 76 sign at Fremont and Harrison Streets, the clock tower at 461 Second Street near Bryant, and the brick chimney at 178 Townsend Street near Third. To the west of the Project Area is a former warehouse area, now the Showplace Square wholesale center, partially visible in Figure VI.I.2.

Views from Other Areas

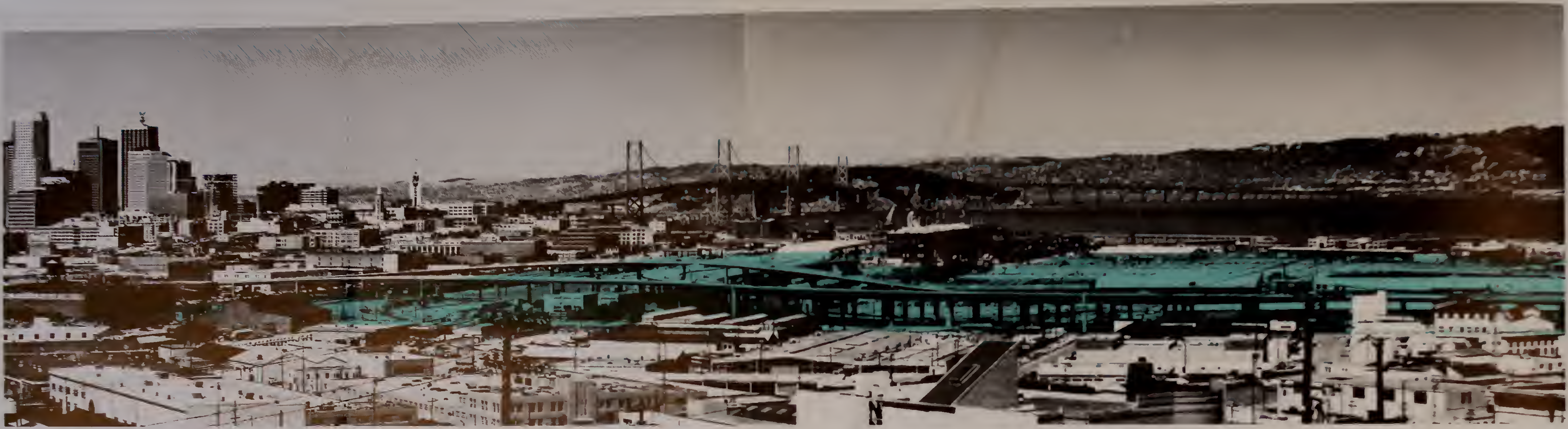
Views toward the Mission Bay Project Area from the north and northwest are limited because of existing taller buildings. From high-rises in the San Francisco financial district, the site is seen in the midground, adjacent to San Francisco Bay with the Oakland hills in the distance. The site characteristics are similar to those described for the Potrero Hill view, above.

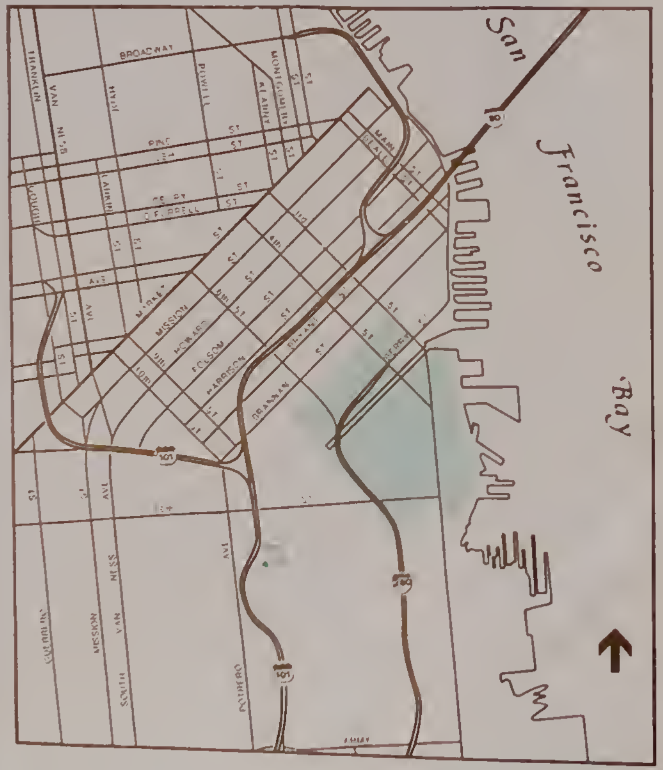
Views of the site from the east, such as from China Basin Street, are limited because of the low elevation of viewpoints near San Francisco Bay; beyond the site, to the south and west, Potrero Hill and Twin Peaks are the major features.

URBAN DESIGN

Urban Design Features

The needs of railroading, shipping and warehousing industries that developed in 19th century and early 20th century San Francisco were the major determinants of street patterns, waterways and building forms in the Mission Bay area. Existing street and block




San Francisco Bay
BROADWAY
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MONTGOMERY
HYDE
VAN NESS
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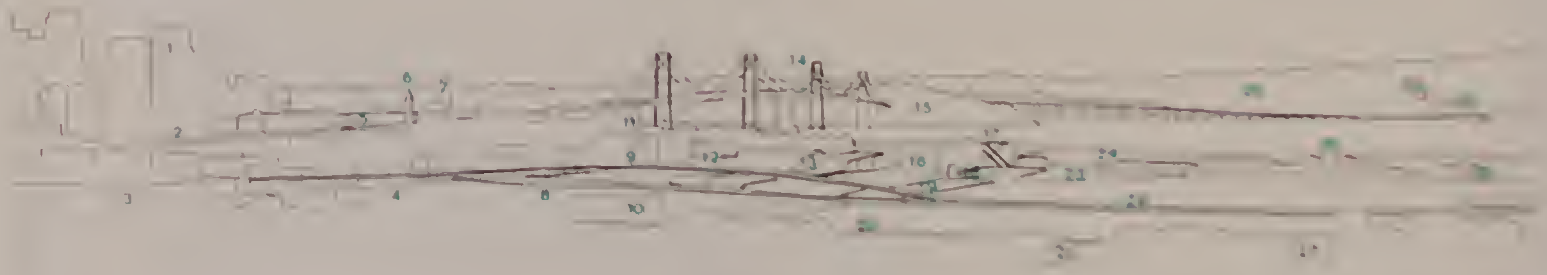
PINE
O'FARRELL
MARKET
MISSION
HOWARD
FOLSOM
HARRISON
BRYANT
80
101
280

1 DOWNTOWN SAN FRANCISCO HIGHRISES
2 FIFTH STREET ON RAMP TO I 80
3 BAKER HAMILTON DESIGN CENTER
4 TOWNSEND STREET
5 EMBARCADERO FREEWAY
6 CLOCK TOWER - 461 SECOND STREET NEAR BRYANT STREET
7 UNION 76 SIGN
8 SIXTH STREET ON RAMP TO I 280
9 SIXTH STREET OFF RAMP FROM I 280
10 CHANNEL STREET PUMPING STATION
11 SMOKESTACK - 178 TOWNSEND NEAR THIRD STREET
12 CALTRAIN COMMUTE TERMINAL
13 UNUSED I 280 STUB
14 SAN FRANCISCO - OAKLAND BAY BRIDGE
15 YERBA BUENA ISLAND
16 CHINA BASIN BUILDING
17 LEFTY O'DOUL BRIDGE AT THIRD STREET
18 PETER J. MALONEY BRIDGE AT FOURTH STREET
19 CHINA BASIN CHANNEL
20 SEVENTH STREET
21 IRWIN STREET
22 I 280
23 FOURTH STREET AND [illegible]
24 PIER 54A
25 OAKLAND HILLS
26 PIER 48
27 HUBBELL STREET
28 CLOSED FIRE STATION 30
29 U.C. BERKELEY
30 EMERYVILLE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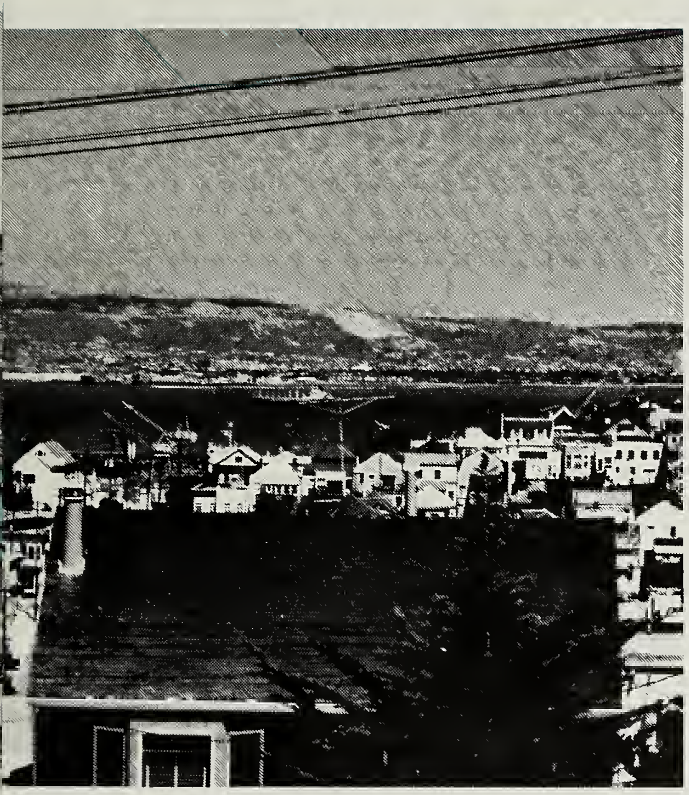
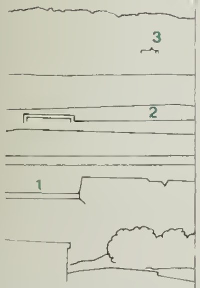
The photograph was taken from the roof of Patrick Henry School, 639 Vermont Street near 18th Street, to provide an unobstructed view of the Project Area. Although the viewpoint is not publicly accessible, it is similar to views partially available from streets and residences on Potrero Hill.



Mission Bay

FIGURE VI.I.2
VIEW OF MISSION BAY
PROJECT AREA
FROM POTRERO HILL

SOURCE: Roger Owen Boyer and Associates



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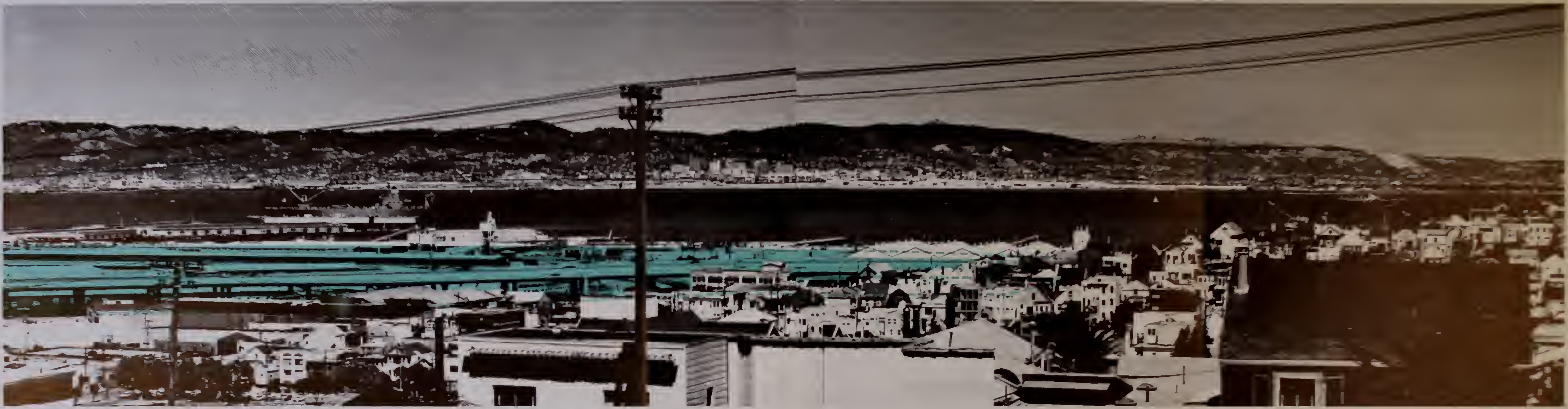
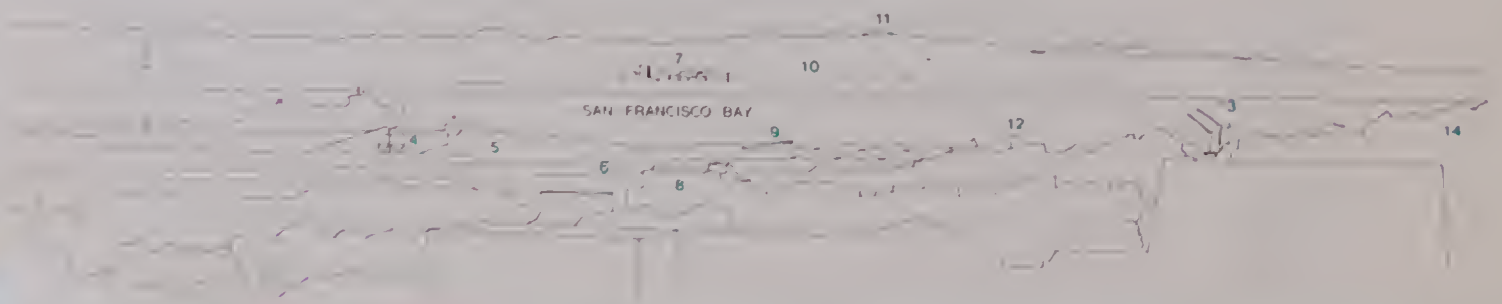


1. SEVENTH STREET
2. PIER 50
3. CLAREMONT HOTEL
4. KAISER SAND AND GRAVEL
5. PIER 54
6. I-280
7. DOWNTOWN OAKLAND
8. 135 MISSISSIPPI STREET NEAR MARIPOSA STREET
9. PIER 64
10. OAKLAND HILLS
11. MT. DIABLO
12. SAND AND GRAVEL CONVEYOR
13. PORT CRANES AT 19TH STREET NEAR ILLINOIS STREET
14. POTRERO HILL



▨ PROJECT AREA

- - - - - - PROJECT AREA BOUNDARY

Mission Bay

FIGURE VIII.2
VIEW OF MISSION BAY
PROJECT AREA
FROM POTRERO HILL

SOURCE: Roger Owen Boyer and Associates

patterns were only partially extended into this area; Mission Bay streets were developed based on large blocks permitting development of warehouse and industrial buildings. Few streets are provided with curbs, gutters and sidewalks. The elevated I-280 Freeway, the Sixth Street and the Third Street stub off-ramp were constructed across the site in the 1970s, and many railroad tracks have been removed recently, reflecting the increased use of highway transportation.

Pedestrian-oriented areas in Mission Bay are limited primarily to unimproved open space near China Basin Channel and the Bay; there is no housing except for a houseboat community on the south side of the channel, and no major trees or landscape features (see VI.D. Community Services and Infrastructure, Recreation and Parks, p. VI.D.11-.14, for a discussion of Mission Bay open space resources). Due to the Project Area's South of Market location and its low building scale, sunshine and distant views are abundant.

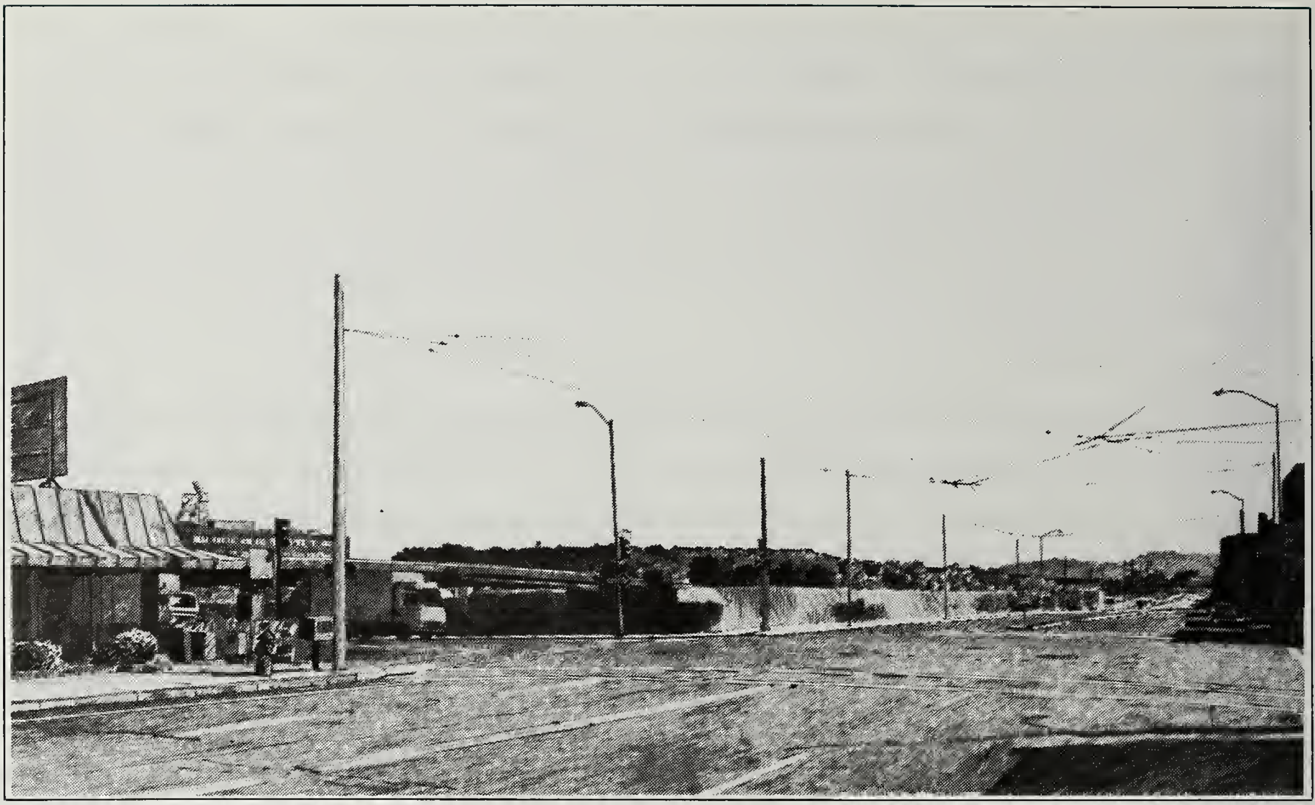
Most buildings on the site are large, one-story structures built of utilitarian materials. The buildings usually have no special architectural form, windows or decorative elements that provide pedestrian interest. However, even with the industrial nature of the site, a variety of urban design conditions do exist. Six selected locations illustrate typical streetscapes in the Mission Bay Project Area and represent conditions that apply to other areas of the site.

Third and Townsend Streets

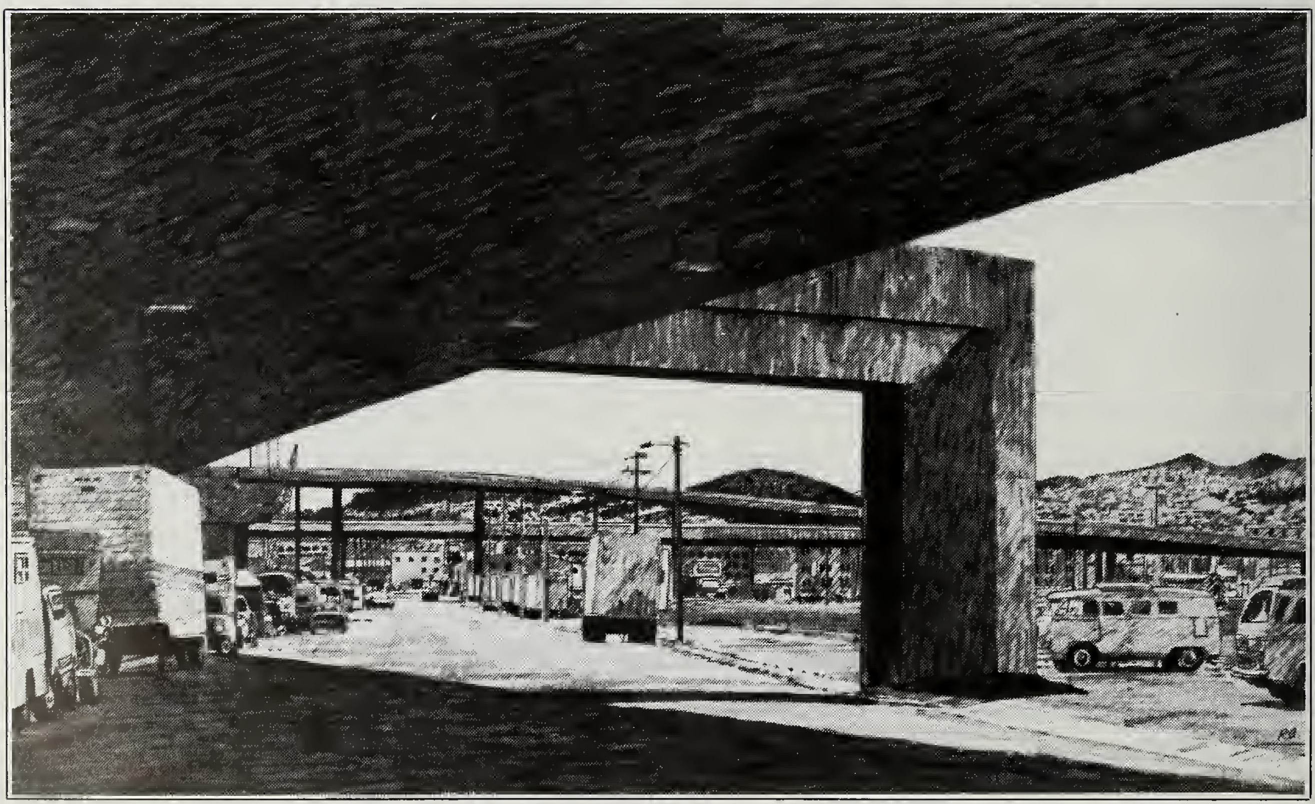
The intersection of Third and Townsend Streets is at the northern boundary of the Project Area, the area closest to downtown San Francisco. It is the former Southern Pacific railroad station site (see Viewpoint 1, Figure VI.I.3) currently the San Francisco Recreational Vehicle (RV) Park. Narrow sidewalks flank both streets and the RV park is screened by six-foot high, vine-covered, chain-link and wooden fences.

Third Street is one-way northbound, with much of the traffic originating from the I-280 Fourth Street off-ramp. Townsend Street is a two-way street. Before the filling of Mission Bay, this area was known as Steamboat Point.

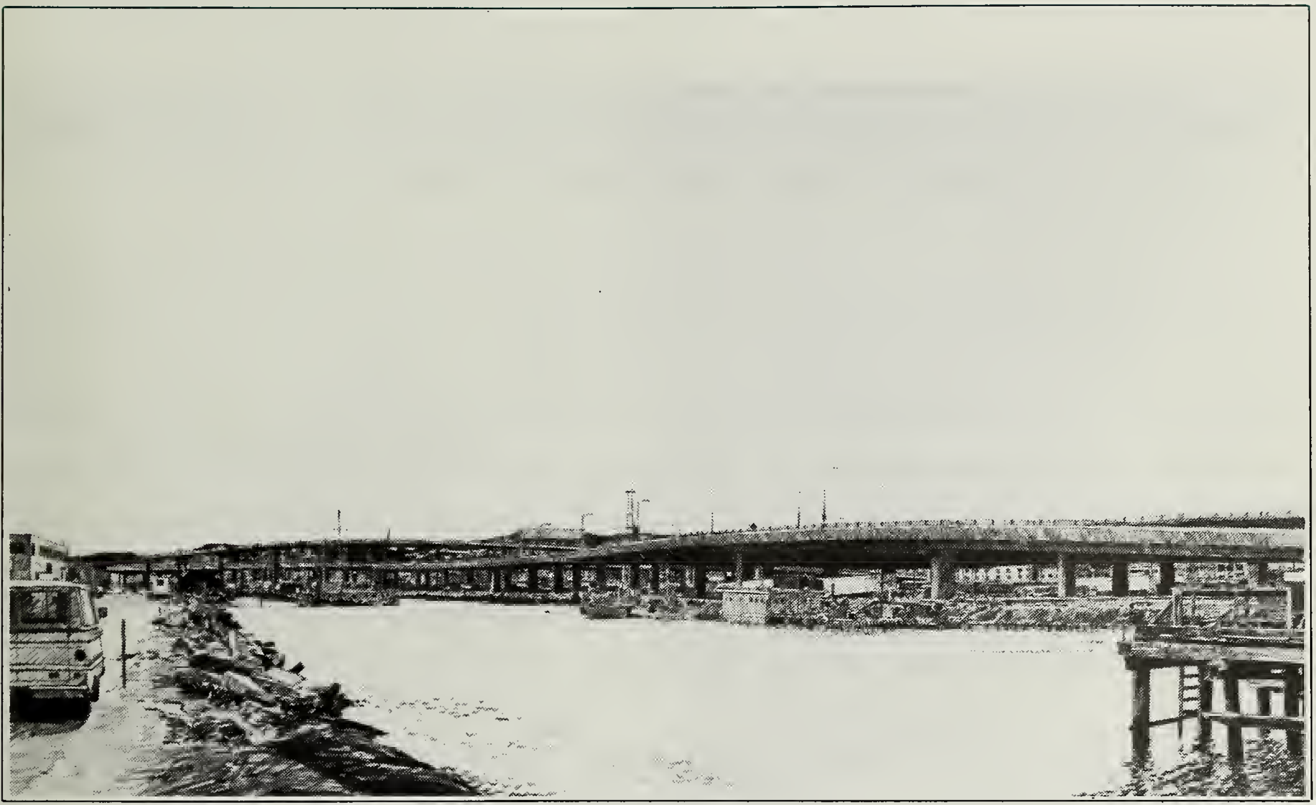
The adjacent buildings include fast-food restaurants, storefronts displaying wholesale industrial products and parking lots. In the distance as one looks down Townsend Street, Potrero Hill is seen south of the Project Area, with Diamond Heights to the right. Older



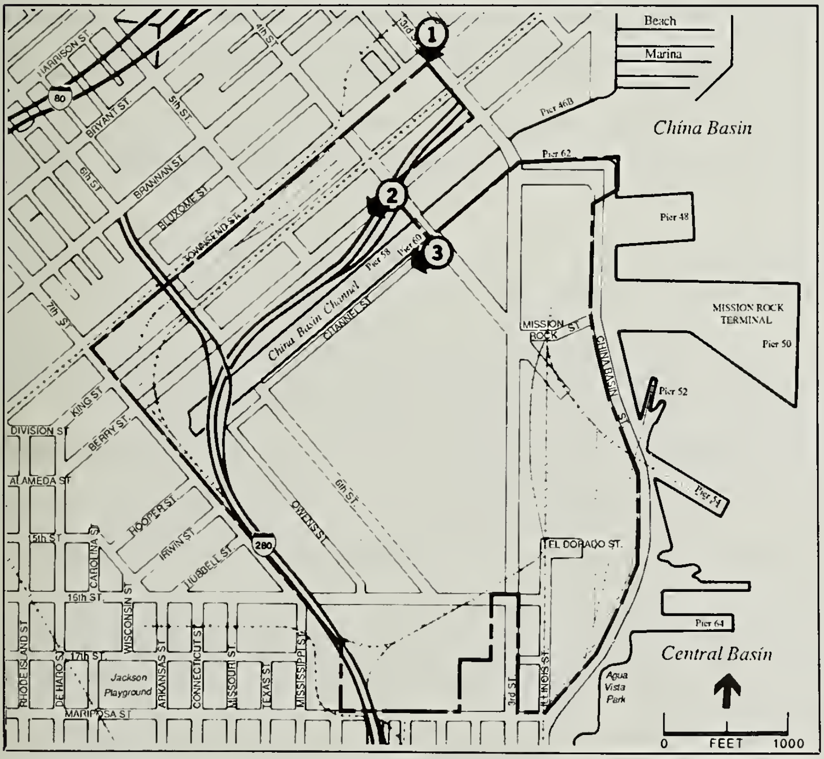
VIEWPOINT 1: Third and Townsend Streets



VIEWPOINT 2: Berry Street near Fourth Street



VIEWPOINT 3: China Basin Channel near Fourth Street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KING ST
DIVISION ST
BERRY ST
ALAMEDA ST
HOOPER ST
IRWIN ST
HUBBELL ST
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CAROLINA ST
16th ST
WISCONSIN ST
17th ST
RHODE ISLAND ST
DE HARO ST
Jackson Playground
ARKANSAS ST
CONNECTICUT ST
MISSOURI ST
TEXAS ST
MISSISSIPPI ST
MARIPOSA ST
280
OWENS ST
6th ST
China Basin Channel
CHANNEL ST
Pier 58
Pier 60
Pier 46B
Pier 62
Beach
Marina
China Basin
Pier 48
MISSION ROCK TERMINAL
Pier 50
MISSION ROCK ST
CHINA BASIN ST
Pier 52
Pier 54
EL DORADO ST.
3rd ST
ILLINOIS ST
Pier 64
Central Basin
Agua Vista Park
0
FEET
1000

Mission Bay

FIGURE VI.I.3
EXISTING VIEWS -
1. THIRD AND TOWNSEND STREETS
2. BERRY STREET NEAR FOURTH STREET
3. CHINA BASIN CHANNEL NEAR FOURTH STREET

SOURCE: Roger Owen Boyer and Associates

six- to eight-story masonry buildings are seen easterly on Townsend Street (and north on Third, not visible in Figure VI.I.3, p. VI.I.12). As noted on p. VI.I.6, those buildings include many listed by Heritage for architectural quality and typically decorative brick work, cornice and window details.

Berry Street Near Fourth Street

The view southwest down Berry Street near Fourth Street is under the I-280 Freeway north of China Basin Channel (see Viewpoint 2, Figure VI.I.3, p. VI.I.12). The elevated freeway at this point is a concrete structure, supported by widely spaced concrete columns, about 138 feet wide and 30 feet high. The ground area is a parking lot for campers, semi-trailers and cars, some apparently abandoned. Further south is the Fourth Street off-ramp (not shown in Figure VI.I.3).

Berry Street in this area is partially paved, with no sidewalks. Adjacent to each side of the street are open areas, formerly railroad switching yards. Two blocks westerly, the elevated I-280 Sixth Street ramps are visible crossing Berry Street. All of the buildings visible under the off-ramp are west of Seventh Street, outside the Project Area, primarily warehouse and industrial buildings, ranging from one to three stories. Many of the buildings have been converted to furniture showrooms and offices related to the Showplace Square area. Potrero Hill is visible to the south and Twin Peaks to the west.

China Basin Channel Near Fourth Street

China Basin Channel at Channel Street near Fourth Street is the widest (270 feet) portion of the waterway (see Viewpoint 3, Figure VI.I.3, p. VI.I.13). The shoreline in the foreground is concrete rubble placed there to reduce erosion. On the northerly side of the channel is an earthen embankment with docked boats. To the south, Channel Street accommodates parked vehicles during weekdays; the paved street has no curbs or sidewalks. Warehouse and trucking operations are located in the Project Area south of the view. In the easterly (right-hand) portion of the view is part of the outdoor dining deck of Carmen's Restaurant fronting on Fourth Street.

At the westerly end of the channel, the Mission Creek houseboat community is visible, with gangways from Channel Street to a floating pier. This floating pier (not visible in the view) is one of the few pedestrian ways in the Mission Bay Project Area. The embankment adjacent to the houseboat pier, informally improved with some plantings and picnic tables, provides a pathway for pedestrians with views of the houseboats.

The elevated I-280 freeway is north of the waterway. The freeway structure seen above the houseboats is the Sixth Street off-ramp, about 80 feet above the water. The freeway visible in the easterly portion of the view is the I-280 stub and the Fourth Street off-ramp. Berry Street is beneath portions of the freeway and buildings along Townsend Street, north of the Project Area, are visible beneath the freeway. At the westerly end of China Basin Channel, Potrero Hill is visible, partially obscured by the freeway, with the Mt. Sutro tower visible in the background.

Third, Fourth and Mission Rock Streets

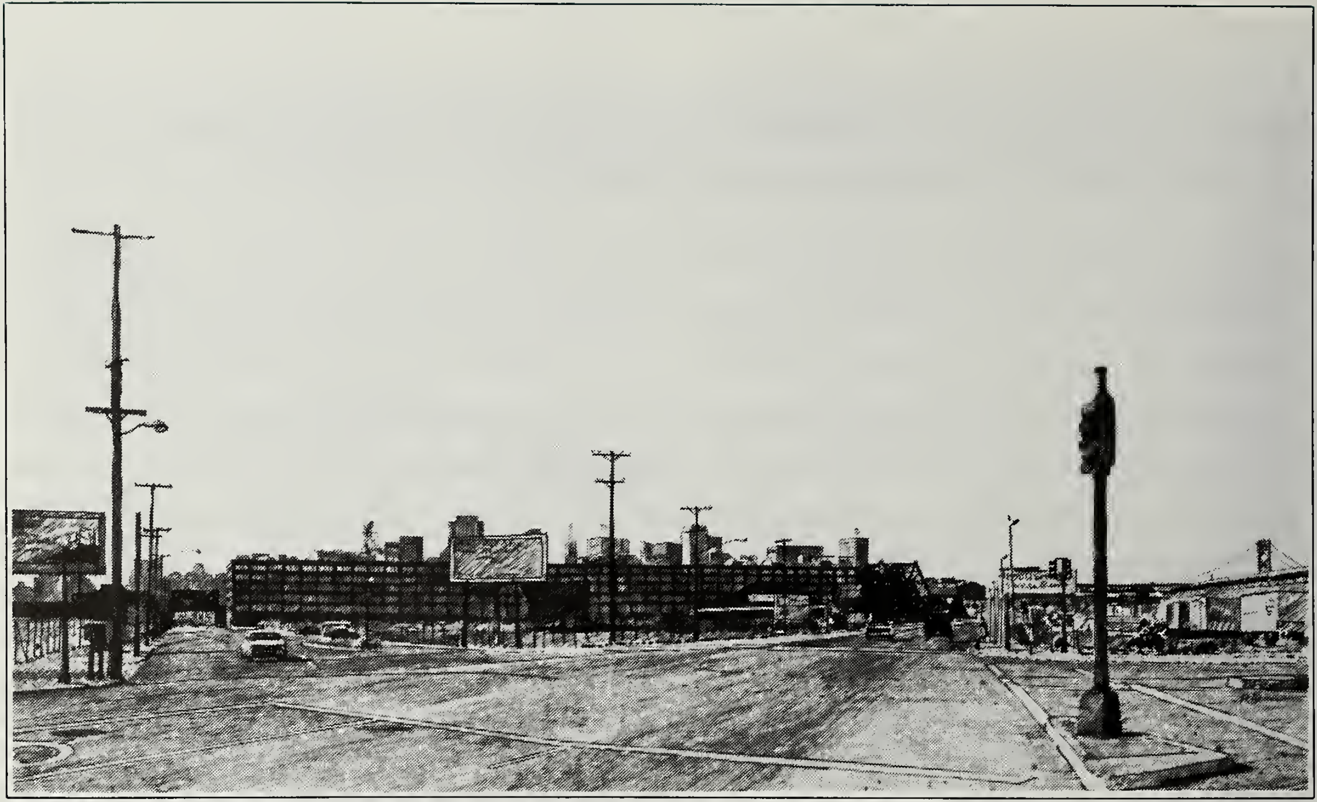
Third and Fourth Streets intersect at a 45° angle, permitting a northerly view to the north up both streets, including the drawbridges in the distance (see Viewpoint 4, Figure VI.I.4). Between Third and Fourth Street is the "Banana Triangle" (formerly an area used for unloading and warehousing bananas shipped to San Francisco). The China Basin Building, the downtown San Francisco skyline and the Bay Bridge are visible to the north.

Former Southern Pacific Railyards

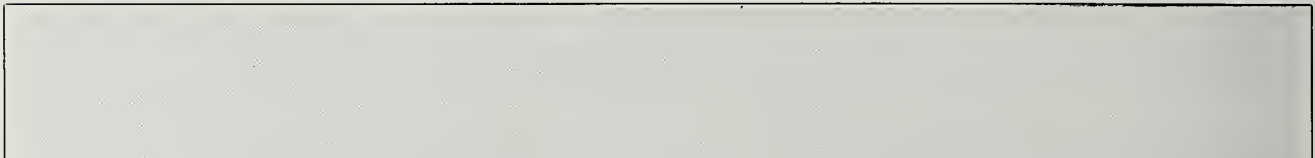
Approximately in the center of the Project Area is the middle of the former railroad yards, about one block north of 16th Street. Most tracks were removed in 1987. The remaining tracks are not in use and much of the area in the view is vacant (see Viewpoint 5, Figure VI.I.4). To the north are views of the downtown San Francisco skyline, and to the east, the China Basin Building and the Fourth Street drawbridge.

Owens Street North of 16th Street

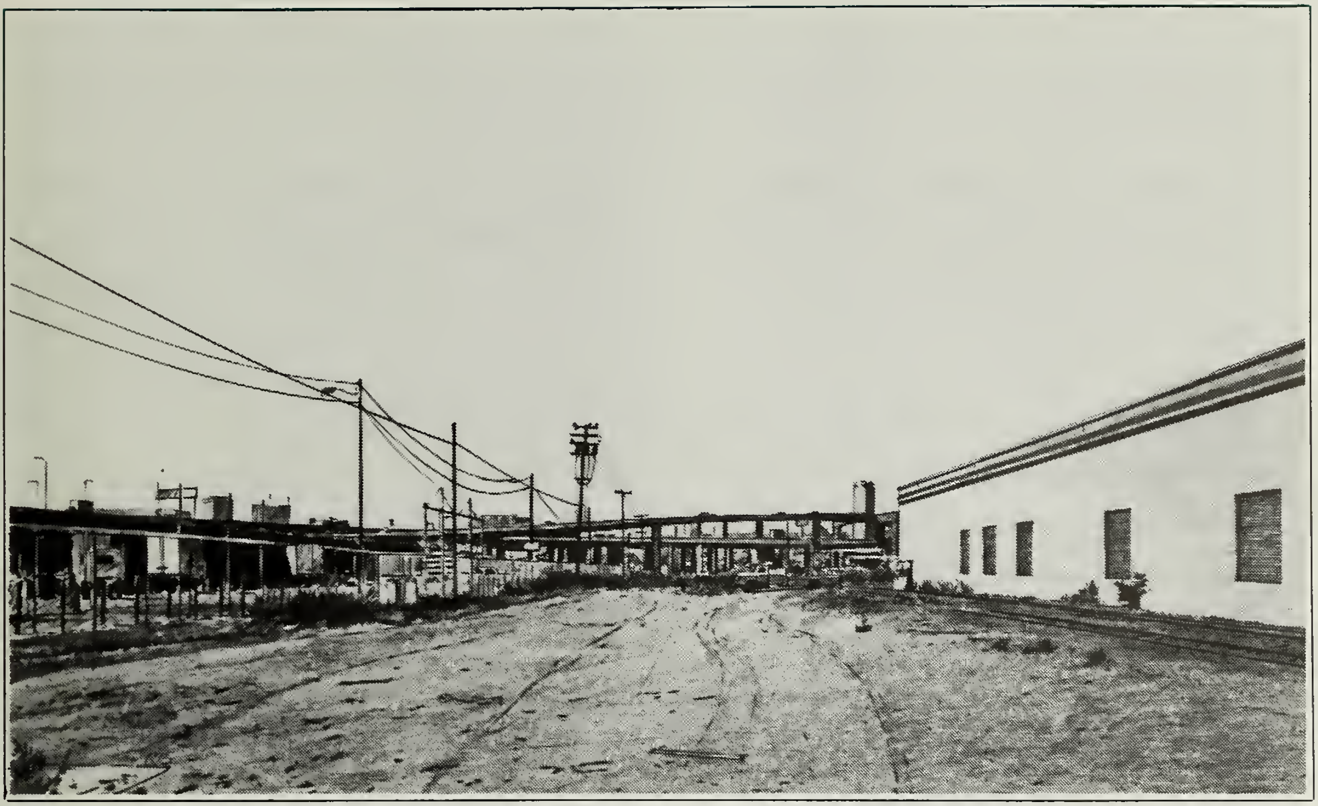
Looking northwest along Owens Street, the predominant feature is the I-280 Freeway near Channel Street, and the elevated Sixth Street off-ramp (see Viewpoint 6, Figure VI.I.4). The Hilton Hotel tower is prominent among other downtown high-rise buildings north of the freeway.



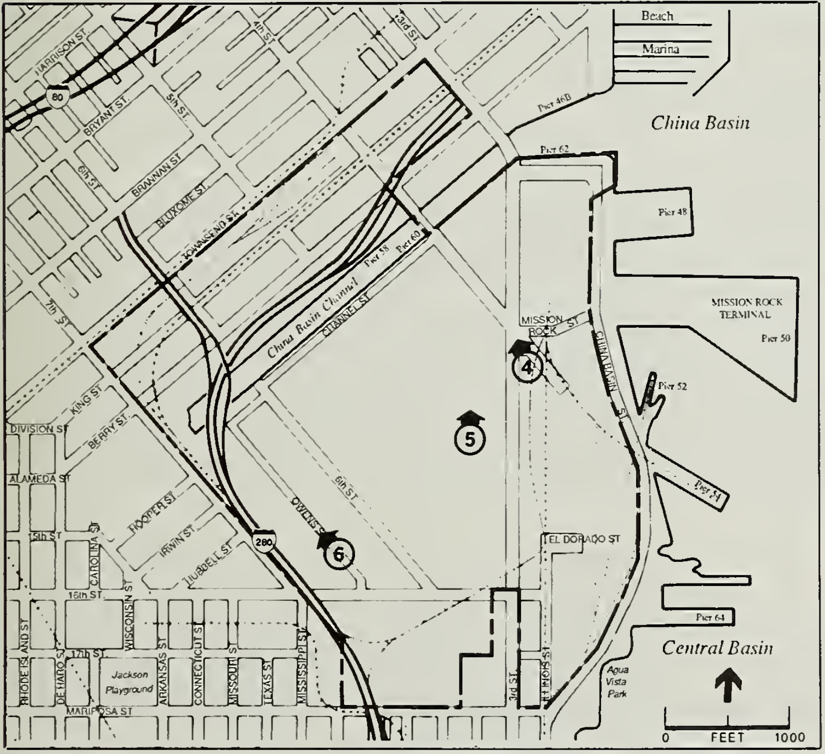
VIEWPOINT 4: Third, Fourth and Mission Rock Streets



VIEWPOINT 5: Former Southern Pacific Railyards



VIEWPOINT 6: Owens Street North of 16th Street


Beach
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Pier 58
China Basin Channel
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MISSION ROCK ST
MISSION ROCK TERMINAL
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BERRY ST
ALAMEDA ST
6th ST
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OWENS ST
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HOOPER ST
IRWIN ST
15th ST
CAROLINA ST
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HUBBELL ST
EL DORADO ST
16th ST
WISCONSIN ST
RHODE ISLAND ST
DE HARO ST
17th ST
Jackson Playground
ARKANSAS ST
CONNECTICUT ST
MISSOURI ST
TEXAS ST
MISSISSIPPI ST
3rd ST
ILLINOIS ST
Pier 64
Central Basin
Agua Vista Park
MARIPOSA ST
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Mission Bay

FIGURE VI.I.4
EXISTING VIEWS -
4. THIRD, FOURTH AND MISSION ROCK STREETS
5. FORMER SOUTHERN PACIFIC RAILYARDS
6. OWENS STREET NORTH OF 16TH STREET

SOURCE: Roger Owen Boyer and Associates

Urban Design Plan

The Urban Design Plan, an Element of the San Francisco Master Plan, enumerates objectives and policies concerned with the City's physical character, its relation to its natural setting, standards for new development, and for preservation of open space and historic and architectural resources./7/ The plan has four objectives relating to: city pattern, conservation, major new development, and neighborhood environment issues. Objective 1 deals with "emphasis on the characteristic pattern which gives to the City and its neighborhoods an image, a sense of purpose, and means of orientation." Policies to implement this objective include protection of major views, reinforcement of existing street patterns, recognition of the total effect of buildings seen together and of the boundaries and connections among districts, and increasing the visibility of major destination areas.

Objective 2 is "conservation of resources which provide a sense of nature, continuity with the past, and freedom from overcrowding." Policies for this objective call for preservation of remaining natural areas, avoiding encroachment on San Francisco Bay, preservation of notable historic and architectural landmarks, respecting the character of older development in the form of new buildings, and a presumption against giving up public street areas for private uses.

Objective 3 calls for "moderation of major new development to complement the City pattern, the resources to be conserved, and the neighborhood environment." Policies for this objective are to promote harmony in the visual relationships between new and older buildings, avoid extreme contrasts in color or shape in new buildings, and relate the bulk, height and form of new buildings to existing development patterns and to open space. Policies also address the special urban design needs in development of large sites.

Objective 4 is for "improvement of neighborhood environment to increase personal safety, comfort, pride and opportunity." Policies for this objective include protecting or buffering residential areas from noise, pollution and physical danger of heavy traffic, providing adequate walkways and parking, emphasizing local commercial centers, and providing adequate recreation space in neighborhoods.

Table VI.I.2 compares policies of the Urban Design Plan with the characteristics of the Alternatives. The table does not enumerate individual urban design policies, but compares the overall intent of the policies to the major urban design characteristics of each Alternative.

TABLE VI.I.2: RELATIONSHIP BETWEEN APPLICABLE URBAN DESIGN POLICIES OF THE MASTER PLAN AND MISSION BAY ALTERNATIVES AT BUILD-OUT/2020

Objectives and Policies	Alternative A	Alternative B	Alternative N
Objective 1 - City Pattern Emphasis of the Characteristic Pattern Which Gives to the City and its Neighborhoods an Image, a Sense of Purpose, and a Means of Orientation.			
Summary of Policies Policies include protection of major views, reinforcement of existing street patterns, recognition of the total effect of buildings seen together, recognition of boundaries of neighborhoods and enhancement of connections among districts, increasing the visibility of major destination areas and routes for orientation, use of landscaping to define open space and recreation amenities, character of local streets and local activity centers.	Alternative A would alter views of the Bay from Potrero Hill. New development in Mission Bay, up to eight stories high, would reduce views of Potrero Hill and Downtown. Views of China Basin Channel would be enhanced by new Project Area open space. North of China Basin Channel, the street pattern would follow the South of Market northeast-southeast grid of major streets; south of the channel, the street pattern would have a north-south orientation characteristic of Potrero Hill and the Mission District.	Alternative B would alter views of the Bay from Potrero Hill. New buildings would reduce views of Potrero Hill and Downtown from Mission Bay. Major open space and wetlands features would be visible in Mission Bay. Alternative B street patterns generally would follow the northeast/southwest grid of South of Market, in contrast to the north-south grid of Potrero Hill.	Alternative N industrial and warehouse uses would generally range up to two to four stories, and office buildings near Third and Townsend would range up to eight stories. These would have more limited view blockage effects than Alternatives A or B. However, Alternative N would not include major open space that could enhance views of the Project Area. Alternative N patterns would generally follow the South of Market northeast/southwest grid.
	Alternative A would have office and medium-high to high density residential areas and S/LI/RD development of larger buildings north of the channel, along Owens Street, I-280 and 16th Street. The central portion of the site would be developed with medium-density residential and retail uses and open space. This would create a "bowl" pattern of more intense development around less intense development. The pattern visually would relate the existing flat topography of the Project Area to higher elevations of Potrero Hill, and to higher building heights of downtown San Francisco.	Alternative B would have medium-high density residential uses north of the channel and south of 16th Street, medium- and low-density residential areas, and open spaces would occupy the central area of these. To a lesser degree than Alternative A, this would create a "bowl" pattern relating the flat topography of the Project Area to Potrero Hill and downtown through higher building heights at the perimeter of the Project Area.	Alternative N would continue and expand the industrial/warehouse development of the Project Area. Incremental replacement of vacant areas formerly occupied by railroad yards or older warehouses would not assure a coherent scale related to Potrero Hill or downtown.

(continued)

TABLE VI.I.2: RELATIONSHIP BETWEEN APPLICABLE URBAN DESIGN POLICIES OF THE MASTER PLAN AND MISSION BAY ALTERNATIVES AT BUILD-OUT/2020 (continued)

Objectives and Policies	Alternative A	Alternative B	Alternative N
	Open space north and south of the channel and east of Third Street at the Bay would be evocative of former Mission Bay, and together with major open space at the mouth of China Basin Channel would enhance shoreline access to the channel and part of the Bay. The Central Square would be a focus of the neighborhood-serving retail area. Those open spaces would be visible from I-280, Third, Fourth and Eighth Streets, the major road approaches to the Project Area, and would be orientation landmarks for Mission Bay.	Open space north and south of the channel would be part of an open space corridor from the channel to the Bay, and would include new wetlands open space. As with Alternative A, open space would be orientation landmarks for Mission Bay.	Although no new public open space or major street landscaping would be created, landscape improvements of a 25-foot-wide open space band would be provided north and south of China Basin Channel.
	S/LI/RD activities near Seventh Street could relate to adjacent Showplace Square uses. S/LI/RD uses south of 16th Street would relate to activities in Lower Potrero Hill.	The primarily residential uses of Alternative B would notably differ from adjacent showroom, light industrial and service uses in Showplace Square, South of Market or Lower Potrero Hill.	The M-2 Industrial uses of Alternative N would continue the pattern of similar uses in South of Market, Showplace Square and Lower Potrero Hill.
	Street landscaping and lighting in Mission Bay would be required to be master-planned to provide consistent orientation for travellers.	Same as Alternative A.	Street landscaping and lighting would be provided incrementally, in individual developments and might not necessarily reflect a coherent plan for the Project Area.
Objective 2 - Conservation of Resources Conservation of Resources which Provide a Sense of Nature, Continuity with the Past, and Freedom from Overcrowding. Summary of Policies Policies include preservation of remaining natural areas and open space, avoiding encroachment on San Francisco Bay, preservation of notable historic and architectural landmarks, respecting the character of older development in the form of new buildings, and a presumption against giving up public street areas for private uses.	Alternative A would dredge the channel and improve the existing shoreline of China Basin Channel and would increase shoreline open space without encroaching on the Bay.	Alternative B would create new wetlands along China Basin Channel, near Pier 48 and south of Pier 54.	Alternative N would not change or expand major open space along the channel or the Bay. It would provide an improved 25-foot-wide open space setback north and south of the channel.

(continued)

TABLE VI.I.2: RELATIONSHIP BETWEEN APPLICABLE URBAN DESIGN POLICIES OF THE MASTER PLAN AND MISSION BAY ALTERNATIVES AT BUILD-OUT/2020 (continued)

Objectives and Policies	Alternative A	Alternative B	Alternative N
	Alternative A would preserve the architecturally notable closed Fire Station 30, which could be used for community facilities. Most existing industrial or service buildings would be removed. The Third and Fourth Street bridges would be preserved. The scale of new development of Alternative A would include more intense uses, up to eight stories, and larger buildings near existing office, wholesale and light industrial uses in South of Market and Showplace Square, and medium-density residential and retail uses, up to seven stories, in the central portion of the Project Area. New buildings would likely contrast with scale and materials of older development in adjacent areas.	Alternative B would not preserve closed Fire Station 30; other community services would be provided at that site. The Third and Fourth Street bridges would be preserved. Alternative B would not include high-density residential uses. It would include one office block up to eight stories. Therefore, the overall scale of buildings would be reduced, compared to that of Alternative A. New buildings might contrast with scale and materials of older development in adjacent areas.	Alternative N would preserve and could reuse closed Fire Station 30, an architectural resource, as a fire house or for other community services. The Third and Fourth Street bridges would be preserved. Alternative N would include office buildings up to eight stories only on one block. It would not include high-density residential uses. The overall scale of buildings would be reduced, compared to that of Alternative A or B. New buildings might contrast with scale and materials of older development in adjacent areas.
	Alternative A would require vacation of certain public streets east and west of Third Street, notably Sixth Street and Illinois east of Third. New Project Area streets would provide access to residential, retail, open space and S/LI/RD uses, would relate to existing street grids in South of Market and Lower Potrero Hill, and would require permanent vacation of some undeveloped streets.	Alternative B would require vacation of certain existing streets east and west of Third Street including Sixth, Illinois and China Basin Streets, and realignment of Mission Rock Street. New Project Area streets would provide access to residential, retail, open space and S/LI/RD uses, would relate to South of Market street patterns, and would require vacation of some undeveloped streets.	Alternative N would not require vacation of existing streets. It would include new streets to serve development.
Objective 3 - New Development Moderation of Major New Development to Complement the City Pattern, the Resources to be Conserved, and the Neighborhood Environment.			
Summary of Policies Policies include promoting harmony in the visual relationships between new and older buildings, avoiding extreme contrasts in color or shape in new buildings, and relating the bulk, height and form of new	Mission Bay development will ultimately replace almost all existing buildings in the Project Area and establish a new context. The new development would relate to open space and architectural resources as discussed above under Objectives 1 and 2. Color, shape, height and bulk of new buildings in	Same as Alternative A.	Scale of development in Alternative N is discussed above under Objective 2. Color, shape, height and bulk of new buildings would be guided by the City Planning Code. Unlike Alternatives A and B, Alternative N would not have overall design guidelines that would prescribe how a plan for the area should be developed.

(continued)

TABLE VI.I.2: RELATIONSHIP BETWEEN APPLICABLE URBAN DESIGN POLICIES OF THE MASTER PLAN AND MISSION BAY ALTERNATIVES AT BUILD-OUT/2020 (continued)

Objectives and Policies	Alternative A	Alternative B	Alternative N
buildings to existing City development patterns and to open space. These concerns are heightened in development of large sites which therefore have special urban design needs. Higher heights in new development should relate to local activity or employment centers.	Alternative A, which cannot be determined at this time, would be guided by City Planning Code requirements, design review procedures, and any specific design guidelines adopted for Mission Bay as part of the development agreement.		
	Pages VI.I.26-33 discuss the effects of Alternative A on views of open space, and pp. VI.I.57-VI.62 discuss potential shadow effects on Project Area open space.	Pages VI.I.33-VI.34 discuss the effectsof Alternative B on views of open space, and pp. VI.I.62-VI.66 discuss potential shadow effects on Project Area open space.	Pages VI.I.34-VI.36 discuss the effects of Alternative N on views of open space, and pp. VI.I.66-VI.69 discuss potential shadow effects on Project Area open space.
	Higher office and high-density residential building heights would be located near employment centers.	Retail activities would be concentrated near more-intense MHDR and MDR residential uses, relating higher heights to local activity. Employment centers in Alternative B would be more limited than in Alternative A.	Alternative N would not include a distinctive activity center.
Objective 4 – Neighborhood Environment Improvement of the Neighborhood Environment to Increase Personal Safety, Comfort, Pride and Opportunity.			
Summary of Policies Policies for this objective include protecting or buffering residential areas from noise, pollution and physical danger of heavy traffic; providing adequate lighting, walkways and parking; emphasizing local commercial centers; and providing adequate and varied kinds of recreation space, public and private, in neighborhoods. Local activity or government office centers should be more prominent and off-street parking should be screened.	Alternative A would include a hierarchy of streets, planned to separate through- and truck-traffic from local-serving routes to reduce noise and air pollution in residential areas. Residential and non-residential uses fronting the same streets, as would occur on Berry, Owens, Third, and 16th Streets, would be impacted without landscaping or limited residential access on the major street to buffer these conflicts. Mission Bay plans would be required to include detailed lighting, landscaping and walkway guidelines.	Alternative B would have an hierarchy of streets. Residential and non-residential uses on Third, Owens and 16th Streets would be affected as in Alternative A.	Alternative N would not include residential uses; the street hierarchy and landscaping would be oriented to M-2 light industrial uses.
	Alternative A would have a neighborhood commercial area and community facilities, on the north-south retail street focused on the Central Square, intended to have a strong pedestrian orientation.	Neighborhood commercial uses would occur on King Street, Owens/Hooper, and Dagget Streets, and community services would focus on Third/Fourth and Owens/16th Streets.	Employee-serving retail uses would be located on Third Street. There would not be a neighborhood commercial center.

(continued)

TABLE VI.I.2: RELATIONSHIP BETWEEN APPLICABLE URBAN DESIGN POLICIES OF THE MASTER PLAN AND MISSION BAY ALTERNATIVES AT BUILD-OUT/2020 (continued)

Objectives and Policies	Alternative A	Alternative B	Alternative N
	Additional community services would focus at the Third-Fourth Streets intersection. Local retail uses would also be planned north of the channel to serve offices and residential areas.		
	Public open space in Alternative A would include a range of passive and active use areas. In addition, the open space corridor extension of Fourth Street east of Third Street, would help provide a visual transition between housing and port-related uses. Residential and office buildings would also include private plazas or greens. Off-street structured or at-grade parking would be provided for hotel, office, S/LI/RD and residential uses. Access across sidewalks could potentially conflict with pedestrian circulation.	Public open space in Alternative B would include a range of passive and use areas. (No active recreation uses would be provided by 2000.) Residential buildings would also include private plazas or greens. Off-street parking for commercial uses would be more limited under Alternative B. Access across sidewalks could potentially conflict with pedestrian circulation.	As Alternative N would not be a residential neighborhood, it would not include major new public open space or recreation areas. An open space strip would be provided north and south of the Bay channel.
	See VI.D. Community Services and Infrastructure, Recreation and Parks, p. VI.82-VI.D.83.	See VI.D. Community Services and Infrastructure, Recreation and Parks, p. VI.83-VI.D.85.	See VI.D. Community Services and Infrastructure, Recreation and Parks, p. VI.D.85-VI.D.86.

SOURCE: Environmental Science Associates, Inc.

IMPACT

The Architectural Resources and Urban Design Impact section discusses six major topics, at build-out, when full effects of physical development of Mission Bay Alternatives would be evident. Those effects would represent worst-case impacts on view blockage or potential shadows on open space. Areas that would be developed by 2000 would have street-level urban design conditions similar to those analyzed for 2020. Architectural Resources identifies direct and indirect effects on on-site and off-site buildings. Visual Quality discusses overall potential scale, height and view blockage as seen from long-range vantage points. Urban Design illustrates and discusses streetscape views and building design issues at six street-level locations. Potential shadow effects of the Alternatives on proposed open space and pedestrian areas are identified, and potential adverse street-level wind effects of structures in Mission Bay are discussed.

ARCHITECTURAL RESOURCES

No buildings in the Mission Bay Project Area are rated by the Department of City Planning (DCP) and Heritage surveys; demolition of existing buildings would not affect any documented architectural resources. However, closed Fire Station 30 is considered of architectural and historic interest. The building may be eligible for listing on the National Register of Historic Places (see p. VI.I.4 and VI.J. Cultural Resources, p. VI.J.16).

Build-Out/2020

Architectural resources located within 1,000 feet of the Project Area boundary that were rated by the DCP and Heritage surveys (see Figure VI.I.1, p. VI.I.2) could be indirectly affected by the development in the Mission Bay Project Area. VI.B. Land Use, Business Activity and Employment, pp. VI.B.106–VI.B.123, discusses the effects of the Alternatives on land uses in the vicinity, including development adjacent to the Project Area on Townsend Street and in Showplace Square. Economic pressure might cause existing buildings in those Nearby Areas to be altered for new uses or to be demolished and replaced as land values increase. Building-specific effects cannot be projected.

Alternative A

Alternative A would preserve and reuse closed Fire Station 30 for fire department or community services uses by the year 2000 (see VI.D. Community Services, Fire Protection, p. VI.D.36). That would maintain the station's architectural and historic integrity.

Alternative A would not affect directly architectural resources adjacent to the Project Area. The Third and Fourth Street drawbridges and China Basin Building are assumed to remain. New construction in Mission Bay fronting on Townsend and Seventh Streets would change the urban design context of existing older brick and masonry buildings listed on those streets in DCP or Heritage surveys (see Figure VI.I.1, p. VI.I.2). The expected urban design context in Mission Bay is discussed below, pp. VI.I.37–VI.I.51. Alternative A development of office space along Townsend would be consistent with the portion of the service/secondary Office District along the north side of Townsend in the South of Market Plan, Proposal for Citizen Review./8/ The proposed South of Market Plan calls for preservation of architecturally significant buildings, including those fronting the north side of Townsend adjacent to the Project Area (see VI.A. Public Plans, Policies and Permits, p. VI.A.9, for a summary of the South of Market Plan). S/LI/RD space near Seventh Street could complement existing wholesale/showroom uses in rehabilitated buildings in Showplace Square.

Alternative B

Closed Fire Station 30 would be demolished and replaced by new streets and community services uses by the year 2020, although not by 2000. Because Alternative B would include primarily residential uses, it could limit available office space South of Market and could increase conversion of older buildings housing service and light industrial uses elsewhere in South of Market to office uses (see VI.B. Land Use, Business Activity and Employment, p. VI.B.111). Other effects of Alternative B would be the same as Alternative A.

Alternative N

Alternative N, as with Alternative A, would retain and reuse closed Fire Station 30. Alternative N would continue rail and Caltrain terminal uses along Townsend and Seventh Streets and so would not change the existing context of architectural resources along those streets west of Fourth Street. Alternative N would provide light industrial space including some offices that would reduce development pressures on similar space in South of Market. That could reduce conversion of older buildings to such uses (see VI.B. Land Use, Business Activity and Employment, p. VI.B.112).

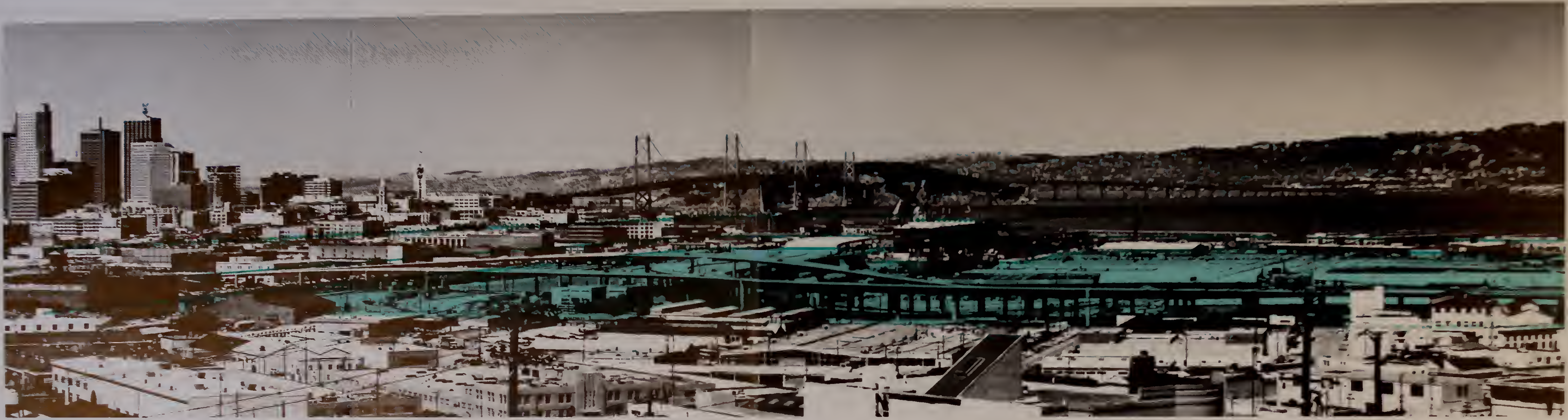
VISUAL QUALITY

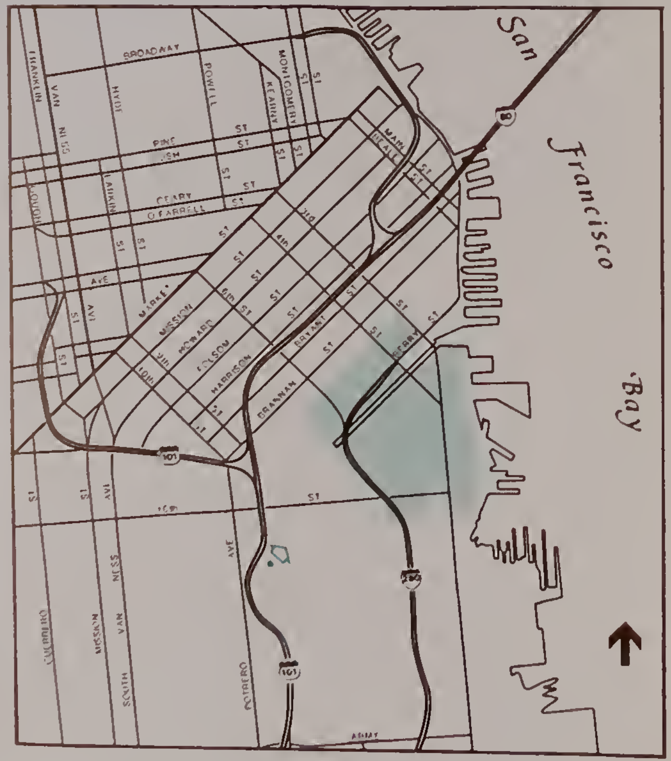
Build-Out/2020

New buildings in Mission Bay would affect views of the Project Area from surrounding areas. Figure VI.I.5, pp. VI.I.28-VI.I.29, is a panoramic view from Potrero Hill near the Project Area with lines marking the upper limits of building heights that may obscure all or part of the existing view from that location; existing views from that location are discussed on pp. VI.I.5-VI.I.6. The upper dotted line is 110 feet high, representing the upper limit of eight-story buildings, the maximum height planned for Mission Bay. Stairway structures and mechanical penthouses could extend above that height as permitted by the City Planning Code./9/ A 40-foot height line and ground level also are indicated. The 40-foot height approximates that of a three-story office building or a four-story residential building. The three lines are drawn at the furthest point in the Mission Bay Project Area from the viewpoint. The lines therefore represent the highest condition that would occur as seen at that location on Potrero Hill. The lines do not imply that a solid wall of buildings would be constructed to this height. Actual view blockage would depend upon site plans, design, height, bulk and setbacks of specific buildings, and open space and roadway location./10/

Alternative A

Views from Potrero Hill. Existing buildings in the Project Area would be demolished and replaced with new structures by the year 2020, with the exception of the Channel Street Pump Station at China Basin Channel and closed Fire Station 30. The new buildings would vary in height from three stories up to eight stories, plus mechanical penthouses as permitted by the City Planning Code. The height of an eight-story office building could vary from 98 feet to 110 feet high. In addition, mechanical penthouses could extend up to 16 feet above the main building height, resulting in an average overall height of about 120 feet for office buildings./9/ (Therefore, eight-story office buildings would be as high as the upper dotted line on Figure VI.I.5.) The height of an eight-story residential building

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HARRISON
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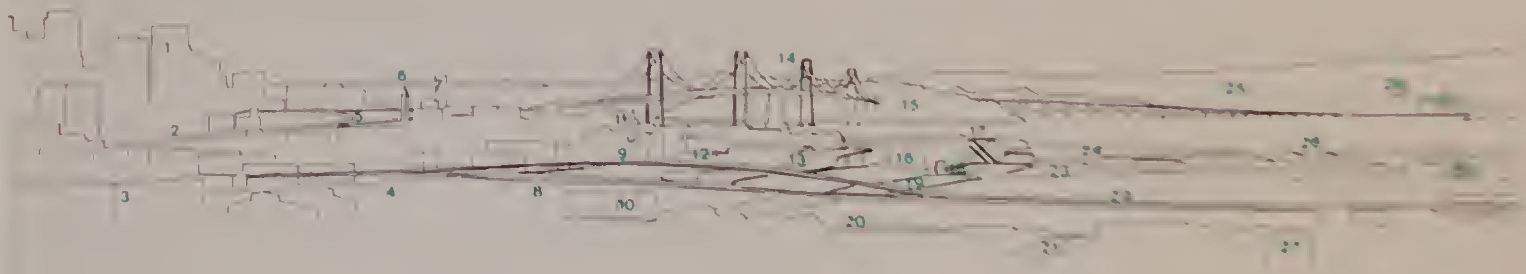
80
ARMY

This photograph was taken from the roof of Patrick Henry School, 639 Vermont Street near 18th Street, to provide an unobstructed view of the Project Area. Although the viewpoint is not publicly accessible, it is similar to views partially available from streets and residences on Potrero Hill.

1. DOWNTOWN SAN FRANCISCO HIGHRISES
2. FIFTH STREET ON RAMP TO I-80
3. BAKER HAMILTON DESIGN CENTER
4. TOWNSEND STREET
5. EMBARCADERO FREEWAY
6. CLOCK TOWER - 461 SECOND STREET NEAR BRYANT STREET
7. UNION 76 SIGN
8. SIXTH STREET ON-RAMP TO I-280
9. SIXTH STREET OFF-RAMP FROM I-280
10. CHANNEL STREET PUMPING STATION
11. SMOKESTACK - 178 TOWNSEND NEAR THIRD STREET
12. CALTRAIN COMMUTE TERMINAL
13. UNUSED I-280 STUB
14. SAN FRANCISCO - OAKLAND BAY BRIDGE
15. YERBA BUENA ISLAND
16. CHINA BASIN BUILDING
17. LEFTY O'DOUL BRIDGE AT THIRD STREET
18. PETER J. MALONEY BRIDGE AT FOURTH STREET
19. CHINA BASIN CHANNEL
20. SEVENTH STREET
21. IRWIN STREET
22. I-280
23. FOURTH STREET AND BANANA TRIANGLE
24. PIER 48A
25. OAKLAND HILLS
26. PIER 48
27. HUBBELL STREET
28. CLOSED FIRE STATION 30
29. U.C. BERKELEY
30. EMERYVILLE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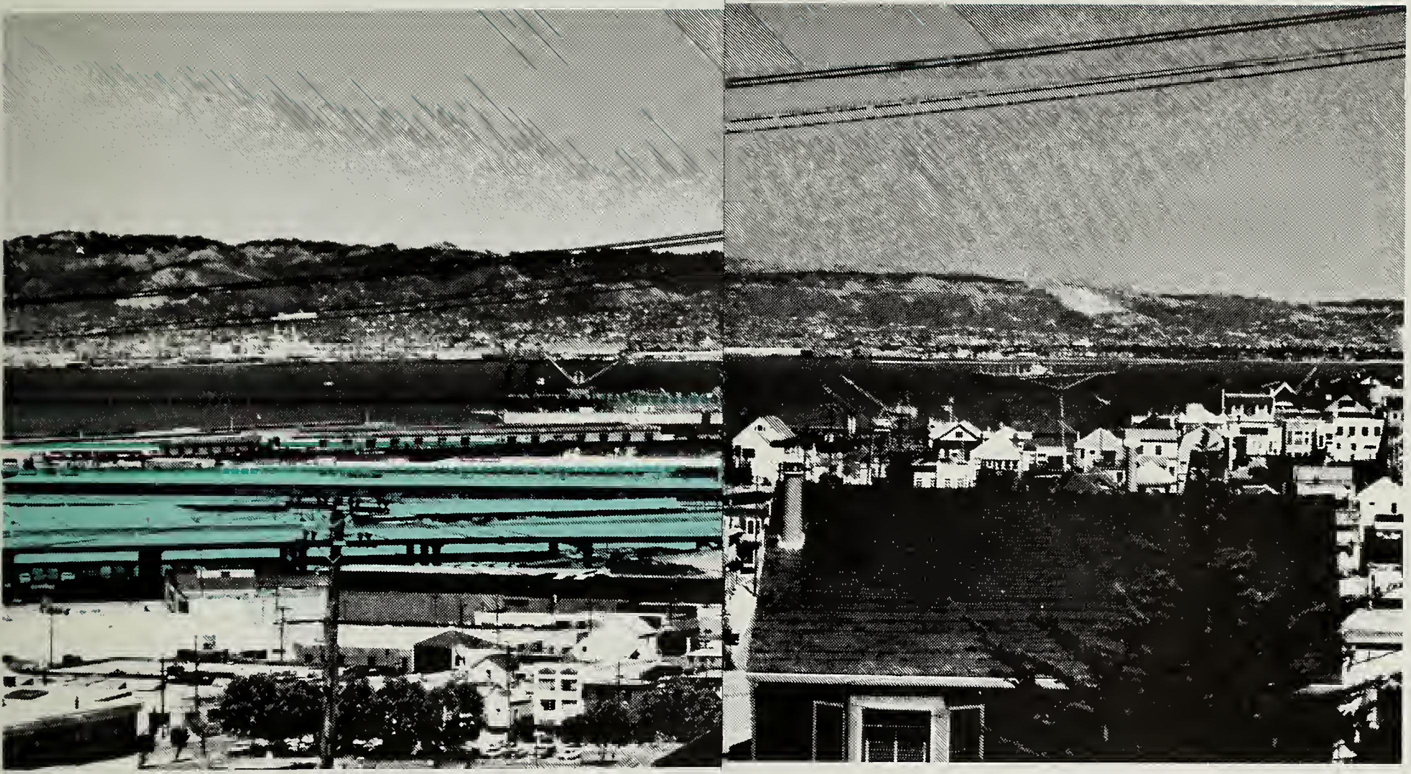
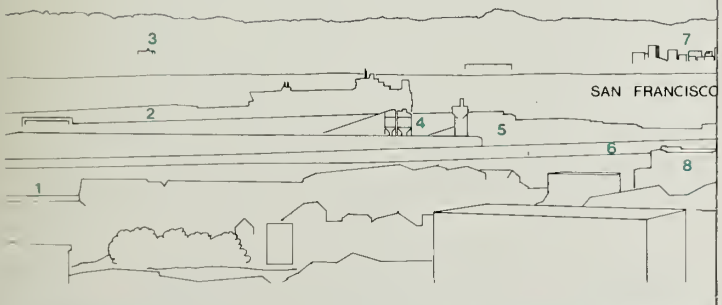


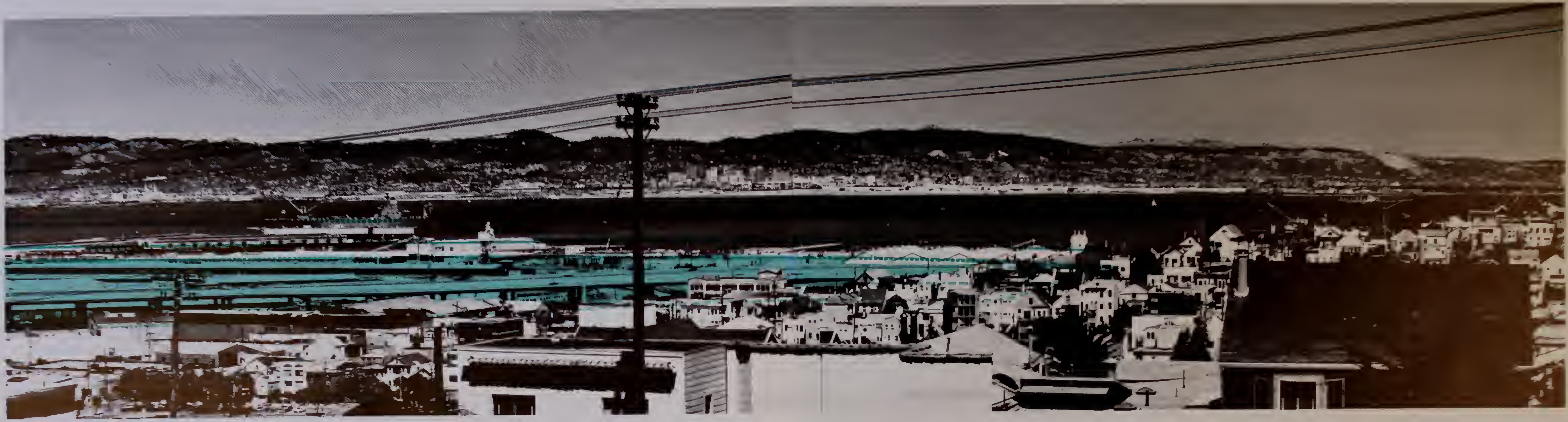
1.	SEVENTH STREET	8.
2.	PIER 50	9.
3.	CLAREMONT HOTEL	10.
4.	KAISER SAND AND GRAVEL	11.
5.	PIER 54	12.
6.	I-280	13.
7.	DOWNTOWN OAKLAND	14.



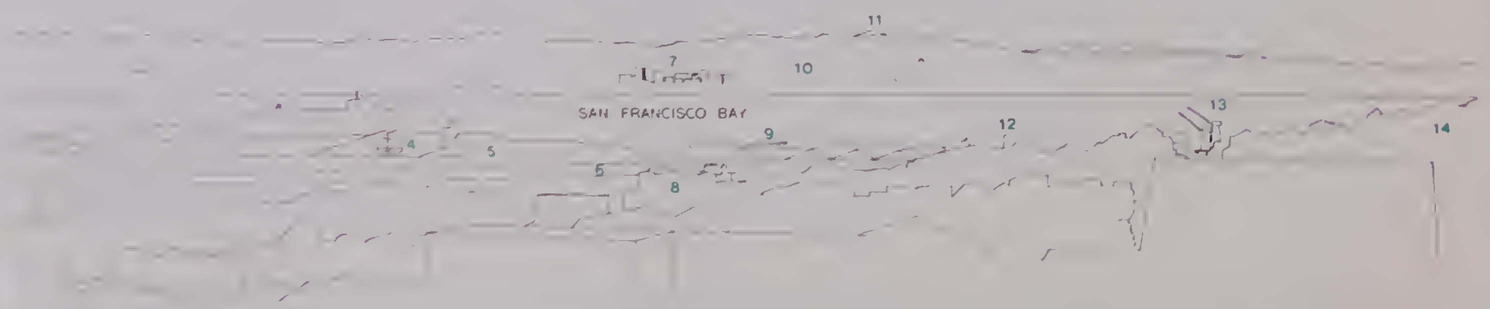
Mission Bay

FIGURE VI.I.5
MISSION BAY HEIGHT LIMITS – VIEW FROM POTRERO HILL

SOURCE: Roger Owen Boyer and Associates



1. SEVENTH STREET
2. PIER 50
3. CLAREMONT HOTEL
4. KAISER SAND AND GRAVEL
5. PIER 54
6. I-280
7. DOWNTOWN OAKLAND
8. 135 MISSISSIPPI STREET NEAR MARIPOSA STREET
9. PIER 64
10. OAKLAND HILLS
11. MT. DIABLO
12. SAND AND GRAVEL CONVEYOR
13. PORT CRANES AT 19TH STREET NEAR ILLINOIS STREET
14. POTRERO HILL



🟦 PROJECT AREA

– – – – – – – PROJECT AREA BOUNDARY

HEIGHT LIMITS (Lines drawn at furthest point from Potrero Hill viewpoint):

•••••••••• 110 feet

—— 40 feet

•••••••••• GROUND LEVEL

Mission Bay

FIGURE VI.I.5
MISSION BAY HEIGHT LIMITS –
VIEW FROM POTRERO HILL

SOURCE: Roger Owen Boyer and Associates

would vary from 83 feet to 90 feet, or from 93 feet to 105 feet with penthouses, an average height of about 100 feet. The top of eight-story residential buildings would be about 4 to 17 feet lower than the 110-foot line on Figure VI.I.5.

The overall scale of buildings in Alternative A would vary, with more-intense office, S/LI/RD and HDR buildings on the north, west and south around MHDR areas. The central portion of the Project Area would be MDR uses focused on the Central Square. That range of scales would create a "bowl" effect, creating a transition from the flat topography of Mission Bay to higher elevations of Potrero Hill to the south, and to the scale of development of larger buildings in South of Market and downtown San Francisco.

When viewed from Potrero Hill, the eight-story office buildings in the Project Area north of China Basin Channel east of Sixth Street would generally appear as high as the upper dotted line on Figure VI.I.5, and would thus obscure views of lower buildings in the South of Market area, but not the downtown San Francisco skyline. (This view is from one representative point on Potrero Hill. As noted in note /6/, the extent of long-range views discussed here would vary at other locations in Potrero Hill. For example, views from lower elevations would not encompass the entire Project Area, because of intervening buildings.) New views would include portions of new open space north and south of the channel. Alternative A would not include buildings tall enough to obscure any part of the Bay Bridge, the Berkeley Hills or Yerba Buena Island from this viewpoint. Parts of the major open space east of Third Street would be visible between new buildings. Part of the Bay visible between the China Basin Building and the lower portion of the Bay Bridge might be partially obscured by new buildings constructed along King and Third Streets. West of Sixth Street along Townsend Street, new S/LI/RD buildings in Mission Bay would be up to 70 feet tall. Those buildings would not be as high as the 110-foot line in Figure VI.I.5; they would partially block the view of existing buildings on the north side of Townsend Street.

- From lower elevations of the north end of Potrero Hill, and other areas west of Seventh Street, the elevated I-280 Freeway is a visual boundary of the Project Area. S/LI/RD and residential development in Alternative A, up to six and eight stories high, respectively, would increase the sense of visual separation between the Project Area and those neighborhoods to the west and south. That effect would vary, depending upon the actual design, height and massing of new structures in Mission Bay.

The removal of the I-280 stub also would change views north of the channel. Alternative A would have MDR and HDR averaging 100 feet in height, replacing the freeway between Third and Sixth Streets. The freeway ranges in height from about 30 to

40 feet above grade, and the new housing would be about two-and-one-half to three times the height of that structure. From the remaining portion of I-280 on the west side of the Project Area, S/LI/RD (up to four stories) and residential (up to eight stories) buildings near Owens would be visible, and would likely block views of open space and the Bay across the Project Area, depending upon building configuration and location.

West of Third Street, Alternative A would include a hotel up to 110 feet high (excluding mechanical penthouse) along Third Street, between the channel and the intersection of Third and Fourth Streets. The hotel could partially block the views from Potrero Hill of the Bay south of China Basin Channel, depending on the actual design and location of the building. Other MDR buildings west of Third Street would be from 60 to 90 feet high and would block views from Potrero Hill of the Third and Fourth Street bridges, China Basin Channel and waterfront sheds along China Basin Street. The buildings would not obscure views of the Bay Bridge or East Bay shoreline.

East of Third Street, MDR buildings would range in height from about 60 to 80 feet. Those buildings would obscure most of the pier sheds along China Basin Street and parts of the Bay. Ships anchored at the end of Pier 50 would be partially visible. The shoreline along the west side of the Bay would be obscured by new buildings. Closed Fire Station 30, to be retained with Alternative A, would not be visible from the Potrero Hill viewpoint. The major open space east of Third would be partially visible between towers of 60- to 90-foot residential buildings west of Third.

With Alternative A, new office buildings north of the channel along Townsend Street could be of a similar height. If all of the buildings were constructed to the maximum height, views of this area could appear as a "bench" of buildings. Bulk controls, if imposed as part of a development agreement, could require setbacks or other bulk controls at upper floors, but would not limit further the maximum height./11/

Views from Other Areas and the Bay. When viewed from street-level areas north of the Project Area, existing buildings in the South of Market area would limit views of Mission Bay buildings except for views down streets. Views of the Project Area easterly or southerly from high-rise buildings in downtown San Francisco would include four- to eight-story office, residential and S/LI/RD buildings and open space, and depending upon their location and configuration, Project Area buildings could limit views of the Bay. Views from downtown would also vary from upper or lower floors. When viewed from the northwest from high-rise buildings, Alternative A would generally have the same characteristics as described above for the Potrero Hill view. The existing pier sheds along China Basin Street and the China Basin Building would be obscured, but views to the Bay, of the Bridge and of Potrero Hill would remain visible.

Views from the Bay, within about 500 feet of the shoreline, would include waterfront sheds at Piers 48 and 50 that would block views of new Mission Bay buildings less than 45 feet high; buildings higher than 45 feet would obscure views of Potrero Hill. Alternative A would not include buildings that would obscure the downtown San Francisco skyline viewed from the Bay.

Alternative B

Views from Potrero Hill. Existing buildings in the Project Area would be demolished and replaced with new structures by the year 2020, with the exception of the existing Channel Street Pump Station. New buildings would vary in height from three stories to eight stories, with maximum height of residential buildings, as described for Alternative A, averaging up to 100 feet high. North of the channel, residential buildings up to eight stories north of Berry Street would be visible from Potrero Hill and would be up to 100 feet high; or ten feet below the 110-foot line in Figure VI.1.5, pp. VI.1.28-VI.I.29. (See Chapter VII. Variations on Alternatives, pp. VII.37-VII.41, for discussion of higher residential towers north of the channel.) From the Potrero Hill viewpoint, residential buildings would block views of buildings to the north. Alternative B would remove the I-280 stub, 30 to 40 feet above grade to provide open space and residential uses. The new open space at grade and medium-high-density residential buildings would be visible from Potrero Hill and from vehicles on the remaining portion of I-280 near the channel.

• From lower elevations of the north end of Potrero Hill, and other areas west of Seventh Street, the elevated I-280 Freeway is a visual boundary of the Project Area. Office and residential development in Alternative B, up to eight stories high, would increase the sense of visual separation between the Project Area and those neighborhoods to the south and west. That effect would vary, depending upon the actual design, height and massing of new structures in Mission Bay.

Alternative B would include a major open space from China Basin Channel southerly to the Bay. Development intensities would generally increase away from the open space: medium-high density residential uses north of the channel, and office uses east of I-280, compared to low- and medium-density residential to the south. Thus, overall density would decrease toward the center of the Project Area as with Alternative A, but the scale would be more uniform, predominantly medium-density residential areas and open space.

West of Third Street, Alternative B would provide open space north of the Third Street and Fourth Street intersection. That open space would retain and enlarge views of the Bay, the Embarcadero, and the Third and Fourth Street bridges. No buildings would obscure the Bay Bridge or the East Bay shoreline from the Potrero Hill viewpoint. Office buildings up to eight stories high between I-280 and Owens Street and other new buildings to the east would block existing views of the Project Area and the Bay from vehicles on I-280, depending upon the configuration and location of buildings. Views could be intermittently available between new buildings.

The area east of Third Street would have buildings ranging in height from about 60 to 100 feet. When viewed from Potrero Hill, those buildings would obscure most of the waterfront pier sheds long China Basin Street and parts of the Bay; ships anchored at the end of Pier 50 would be partially visible. The view of the shoreline along the Bay would be obscured by new buildings.

As with Alternative A, new office buildings along Townsend Street between Owens Street and I-280 under Alternative B, could be of a similar height, up to about 110 feet. If all of the buildings were constructed to the maximum height, views of this area would appear as a "bench" of buildings. Bulk controls could require setbacks or other bulk controls at upper floors, but would not further limit this maximum height.

Views from Other Areas and the Bay. When viewed from street level west of the Project Area, existing buildings would limit views of Mission Bay buildings, except for views down streets. Views easterly or southerly from high-rise buildings in downtown San Francisco would include the entire Project Area, primarily four- to eight-story residential buildings and open space from the channel to the Bay. The waterfront pier sheds along China Basin Street and the China Basin Building would be obscured, but the views from downtown of the Bay, the Bay Bridge and of Potrero Hill would generally remain, depending upon the view location and elevation downtown, and the configuration and location of Project Area buildings.

As with Alternative A, existing waterfront sheds at Piers 48 and 50 would block the view from the Bay, within about 500 feet of the shoreline, of new buildings that are less than 45 feet high. Buildings higher than 45 feet would obscure views of Potrero Hill. Alternative B would not include buildings that would limit views of the downtown skyline from the Bay.

Alternative N

Alternative N reflects future development of the Project Area under existing M-2 (Heavy Industrial) zoning as defined in the City Planning Code and taking into account Master Plan policies. By the year 2020, new M-2 Industrial and Port-Related/M-2 uses would be expected to be primarily buildings up to 40 feet in height for warehousing, distribution, transportation, industrial and port-related businesses; office space would be developed up to 105 feet in height on the Third and Townsend block which is outside the Central Basin

Subarea. For purposes of analysis in this EIR, Alternative N assumes that development would be primarily lower rise buildings, similar in appearance to a business park. See V. The EIR Alternatives and Approval Process, pp. V.A.16–V.A.17, for a discussion of land use assumptions for Alternative N.

Thus, the overall scale of buildings in Alternative N is assumed to be more uniform than Alternatives A and B. Most M-2 buildings would be two to four stories. The major variations in scale would be the eight-story office buildings in the Third and Townsend block, and the continuation of the at-grade CalTrain rail corridor along Seventh and Townsend Streets.

City Planning Code Height and Bulk Districts for the Project Area, however, include 40-foot to 200-foot height districts (see Figure XIV.A.6, p. XIV.A.9)./12/ Therefore, 130-foot to 200-foot high (10- to 16-story) buildings potentially could be developed in the area bounded generally by the channel, Fourth, Third, 16th and Sixth Streets. (The potential for such high-rise development would be limited somewhat by the 5:1 Floor Area Ratio permitted in M-2 districts, and light industrial uses expected to build out in the Project Area with Alternative N, which usually locate in low-rise buildings. Tall buildings could be built on large sites, however.) The 200-foot height district is bounded roughly by Beaton Street, the channel, Fourth and Third Street and extends south of Daggett Street. An 80-foot district extends from the Banana Triangle east of Fourth and continues between Third and the north-south line of Illinois to Mariposa and Minnesota. The Third-Townsend-Fourth-King block is in a 105-foot height district, consistent with eight-story office uses assumed for that block. The height districts in the remainder of Mission Bay range from 40 to 50 feet, generally consistent with development scenarios for Alternative N (see Figure XIV.A.6, p. XIV.A.9).

- Views from Potrero Hill. In views from Potrero Hill, many of the buildings in the Mission Bay Project Area would be demolished and replaced with new structures by the year 2020. Eight-story office buildings near Third and Townsend would obscure existing views of some buildings east and north of this block, in the area below the 110-foot line on Figure VI.I.5, pp. VI.I.28–VI.I.29. Other views of existing buildings along Townsend generally would remain unchanged with Alternative N; the removal of the 30- to 40-foot-high I-280 stub would allow development of industrial buildings up to 40 feet high. Many could be one or two stories. These buildings would not obstruct views from Potrero Hill. From the lower elevations of the north end of Potrero Hill, and other areas west of Seventh Street, the elevated I-280 Freeway is a visual boundary of the Project Area. Compared with buildings up to eight stories with Alternatives A or B, the four-story buildings near the freeway with Alternative N would increase the visual separation between the Project Area and those neighborhoods to a lesser degree.

West of Third Street, Alternative N would provide a new street grid. New buildings that could be constructed would be expected to vary in height from one to four stories. As stated on p. VI.I.34, the Alternative N scenario assumes development of M-2 buildings in that height range. However, under existing City Planning Code height limits, building between 130 and 200 feet high could be built south of the channel and west of Third. Such buildings would appear up to twice as high, when viewed from Potrero Hill, as the 110-foot line shown on Figure VI.I.5, pp. VI.I.28-VI.I.29, and would obscure views of portions of the Bay, Oakland Hills and Bay Bridge. Two- to four-story buildings would not have those effects.

The area east of Third Street would have buildings ranging in height up to 40 feet, but as discussed in VI.B. Land Use, Business Activity and Employment, p. VI.B.103, Alternative N development east of Third in 2020 is expected to be less intense than in other Mission Bay areas, with fewer new buildings and larger areas devoted to outdoor storage, loading on work areas. From Potrero Hill, these buildings would obscure most of the waterfront pier sheds along China Basin Street and parts of the Bay; ships anchored at the end of Pier 50 would be partially visible. Alternative N would have the least effect on existing views east of Third, compared to Alternatives A and B. Existing City Planning Code limits would permit 80-foot-high buildings east of Third. Such structures would limit views of the Bay from Potrero Hill.

Views from Other Areas and the Bay. When viewed from street level west of the Project Area, existing buildings would limit views of Mission Bay buildings, except for views down streets. New buildings would generally be one- to four-story light industrial uses, as described above. The existing pier sheds along China Basin Street and the China Basin Building would be partially obscured, but the views to the Bay, the Bridge, and of Potrero Hill would remain visible. When viewed from the Bay, the existing waterfront pier sheds at Piers 48 and 50 would block the views of new buildings less than 45 feet high; buildings higher than 45 feet would obscure views of Potrero Hill. Under existing zoning and height limits, buildings up to 200 feet high could be built west of Third and up to 80 feet east of Third. Those structures could obscure part of the downtown skyline seen from the Bay.

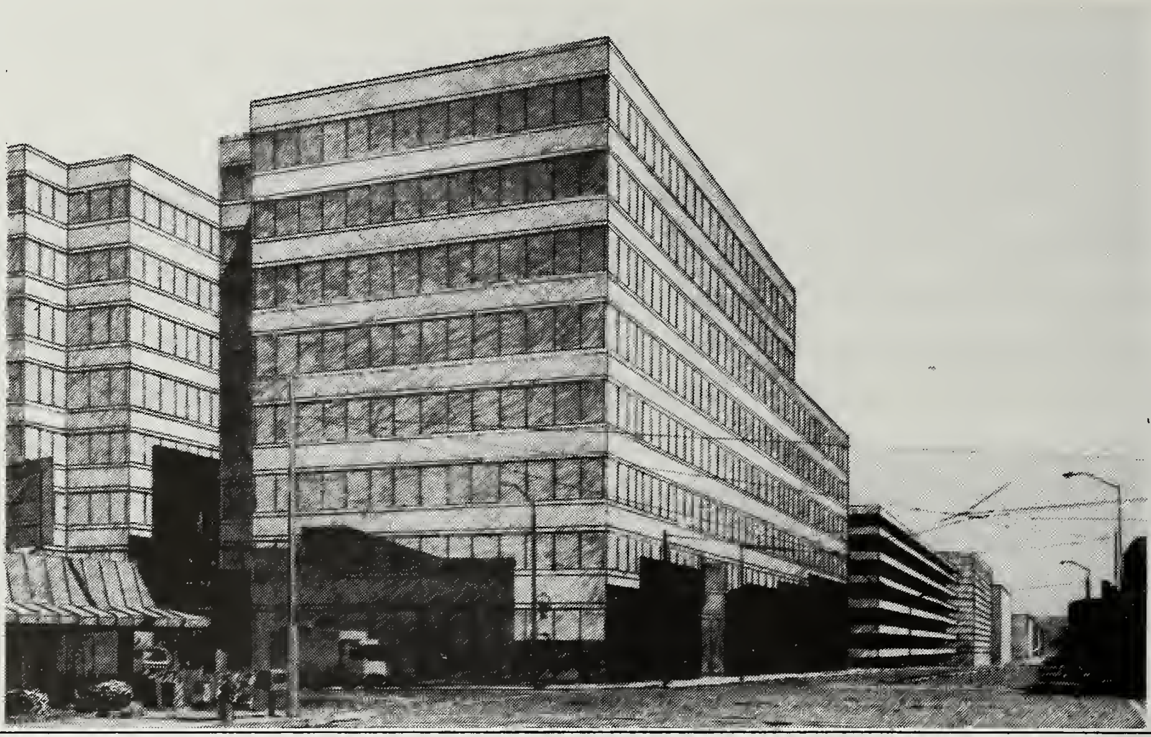
URBAN DESIGN

Build-Out/2020

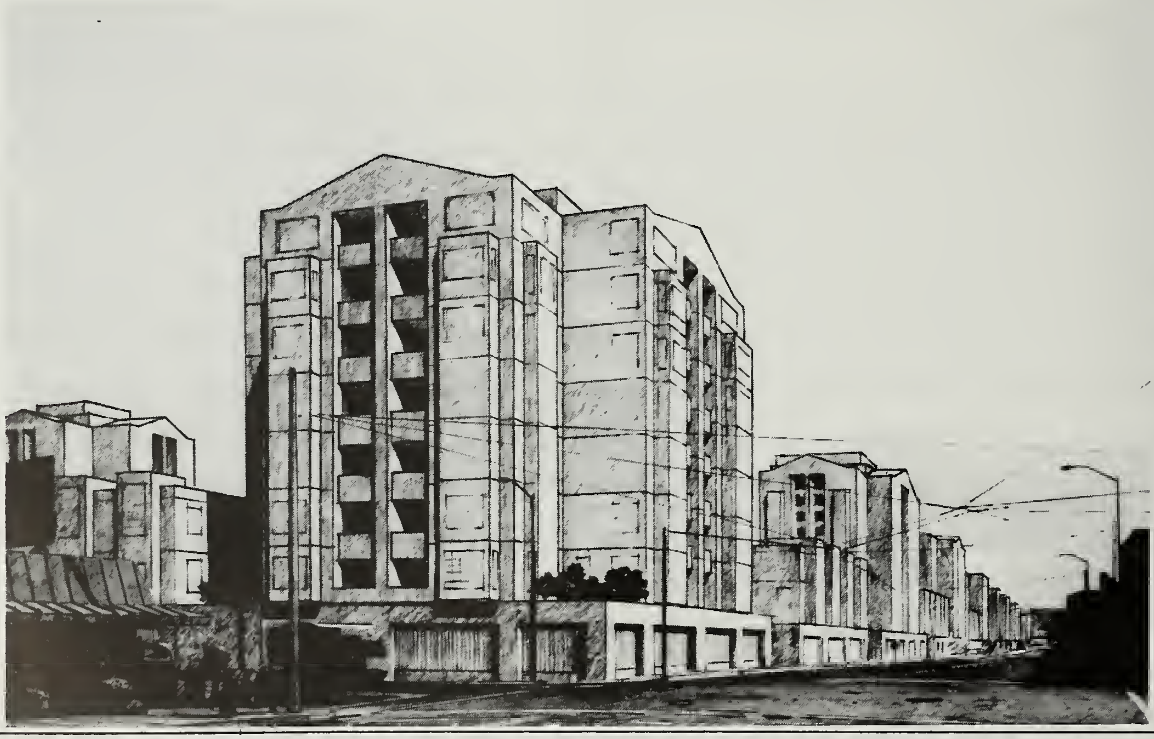
Figures VI.I.6 through VI.I.11 include buildings added to existing views of the Project Area shown in Figures VI.I.3 and VI.I.4, pp. VI.12–VI.I.13 and VI.I.16–VI.I.17, to illustrate each Alternative in the year 2020. The illustrations do not represent actual building proposals. They are conceptual designs that reflect potential zoning controls for each Alternative based on the criteria described in Appendix A, The EIR Alternatives, Table XIV.A.1, p. XIV.A.1. A variety of building configurations and design is possible, but the illustrations represent minimal compliance with City Planning Code requirements, and provide a comparative analysis of each viewpoint for each Alternative in the year 2020. Consistent with the Alternative N scenario for M-2 Industrial and Port-Related/M-2 development in the Project Area, the designs for Alternative N assume lower-scale buildings, rather than 80- to 200-foot buildings allowable under existing height limits in parts of the Project Area. See Chapter V. The EIR Alternatives and Approval Process, pp. V.A.16–V.A.17, for a discussion of land use assumptions for Alternative N.

Viewpoint 1 – Third and Townsend Streets

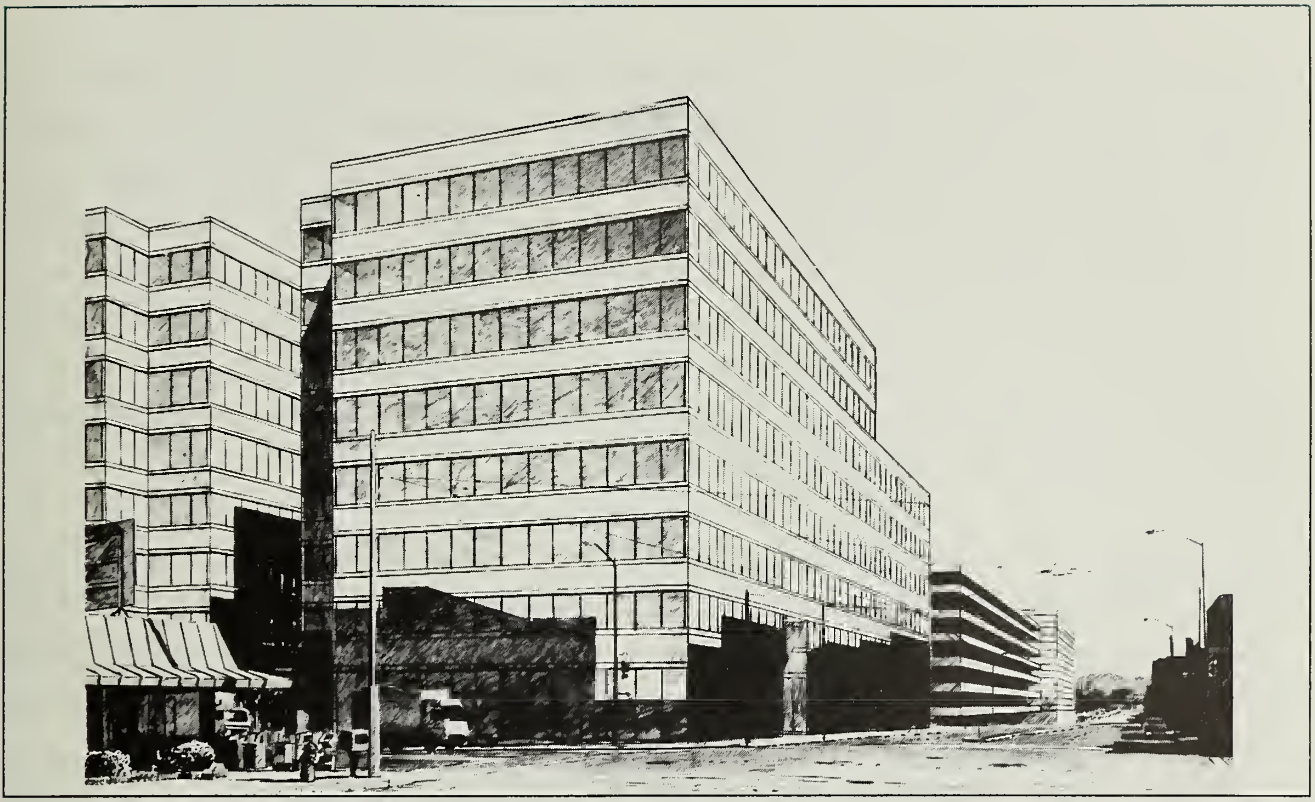
Alternative A. Views from Townsend Street and Third Street south would include eight-story office buildings and parking structures replacing the existing San Francisco RV park, Caltrain commute terminal and railroad tracks (see Figure VI.I.6). These buildings, with associated open space, would occupy all blocks along Townsend Street to Sixth Street. Open space would not be visible as it is assumed to be on the south (King Street) side of the buildings to maximize sun exposure, (and to present a conservative impacts scenario). First-floor retail uses in these buildings are also assumed to be located on the south side of the buildings, adjacent to the open space. The street-level frontage along Third and Townsend Streets is assumed to include offices, building entrances, exits, structural walls and parking garages. The buildings illustrated represent secondary office space with large floor areas (30,000 to 45,000 square feet per floor). City Planning Code building and bulk controls, assumed in these scenarios, limit the size of floors and dimensions of buildings above a specific height. Above 80 feet or six stories, the maximum width of these buildings would be 110 feet. The buildings shown are configured to meet these requirements.



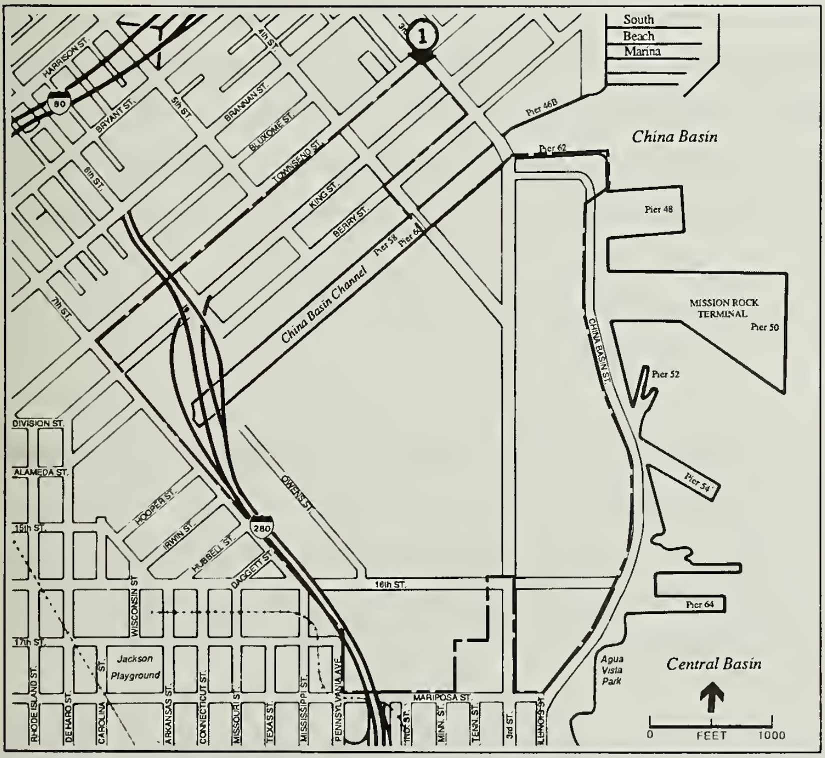
ALTERNATIVE A: Third and Townsend Streets (Viewpoint 1)



ALTERNATIVE B: Third and Townsend Streets (Viewpoint 1)



ALTERNATIVE N: Third and Townsend Streets (Viewpoint 1)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3rd ST.
ILLINOIS ST.

NOTE: The illustrations are building mass and view studies that incorporate conservative height and bulk assumptions to present a reasonable worst-case scenario of street-level views. The illustrations are not renderings of specific building designs, and do not represent the pedestrian or vehicular activity that may occur in the viewpoints.

Mission Bay

FIGURE VI.I.6
ILLUSTRATION OF ALTERNATIVES -
VIEWPOINT 1: THIRD AND TOWNSEND STREET

SOURCE: Roger Owen Boyer and Associates

The new buildings would obscure the existing view of Potrero Hill and the China Basin Building south of Townsend. The ridge of Twin Peaks would remain visible down Townsend Street. Sidewalks along Third and Townsend Streets would include a narrow walkway with parking on the street side (parked vehicles are not shown to avoid obscuring building bases) and the blank walls of office buildings of similar eight-story height and parking structures on the other side. The new buildings would contrast in scale, bulk and facade materials with those of older masonry or brick, often ornamented, buildings fronting the north side of Townsend Street between Second and Fifth Streets adjacent to the Project Area (see Architectural Resources, p. VI.I.5).

Alternative B. Views from Townsend and Third Streets would include seven-story medium-high density residential buildings over one level of parking replacing the RV park and railroad tracks (see Figure VI.I.6, p. VI.I.38). Those buildings, with their associated open space, would occupy the blocks along Townsend Street from Third Street to Seventh Street. Open space is assumed to be on the south (King Street) side of the block for sun exposure, and over the parking structure. First-floor uses along Third and Townsend Streets are assumed to be parking, building entrances, exits and structural walls.

The new buildings would obscure the view of Potrero Hill and the China Basin Building to the south. The ridge of Twin Peaks would remain visible down Townsend Street. As with Alternative A, sidewalks would be narrow with parking (not shown) on the street side and the blank walls of parking structures on the south side. The new buildings would contrast in scale, bulk and facade materials with those of the older masonry or brick, often ornamented, buildings fronting the north side of Townsend Street between Second and Fifth Streets (see p. VI.I.6).

Alternative N. With new office and parking uses between Third and Fourth Streets, Alternative N would appear similar to Alternative A on the block (see Figure VI.I.6, p. VI.I.39). In Alternative N, the blocks along Townsend Street from Fourth Street through Seventh Street would include the Caltrain commute terminal and railroad tracks and would appear similar to existing conditions.

The new buildings would obscure the existing view of Potrero Hill and the China Basin Building, except for the view down Townsend Street and over the existing railroad tracks. Pedestrian conditions would be similar to these described for Alternative A. Sidewalks on the south side of Townsend near the railroad track west of Fourth Street might remain in their current poor condition. The new buildings on the Third and Townsend block would contrast in scale, bulk and facade materials with those of the older masonry or brick, often ornamented, buildings fronting the north side of Townsend Street between Second and Fifth Streets.

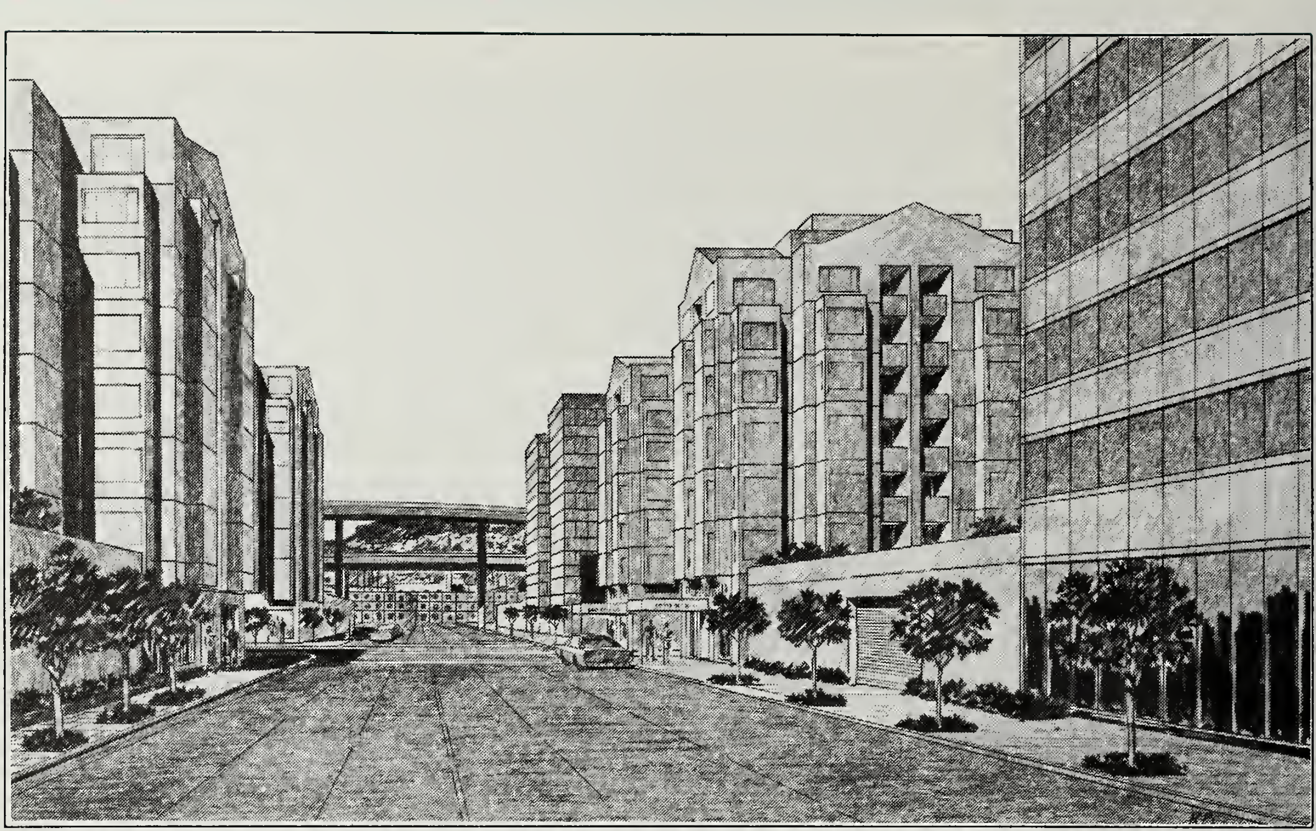
Viewpoint 2 - Berry Street Near Fourth Street

Alternative A. Figure VI.I.7, illustrates the view west on Berry Street near Fourth Street with the I-280 stub demolished and replaced with office and HDR buildings. Removal of the freeway would provide more sky exposure on Berry Street and eliminate views of supporting piers and overhead roadway. The office buildings on the north side of Berry Street would have the same general characteristics as the office buildings described in Figure VI.I.6, Viewpoint 1, Alternative A. The MHDR buildings near Berry and Fifth would range up to seven stories. HDR building south of Berry would be up to eight stories.

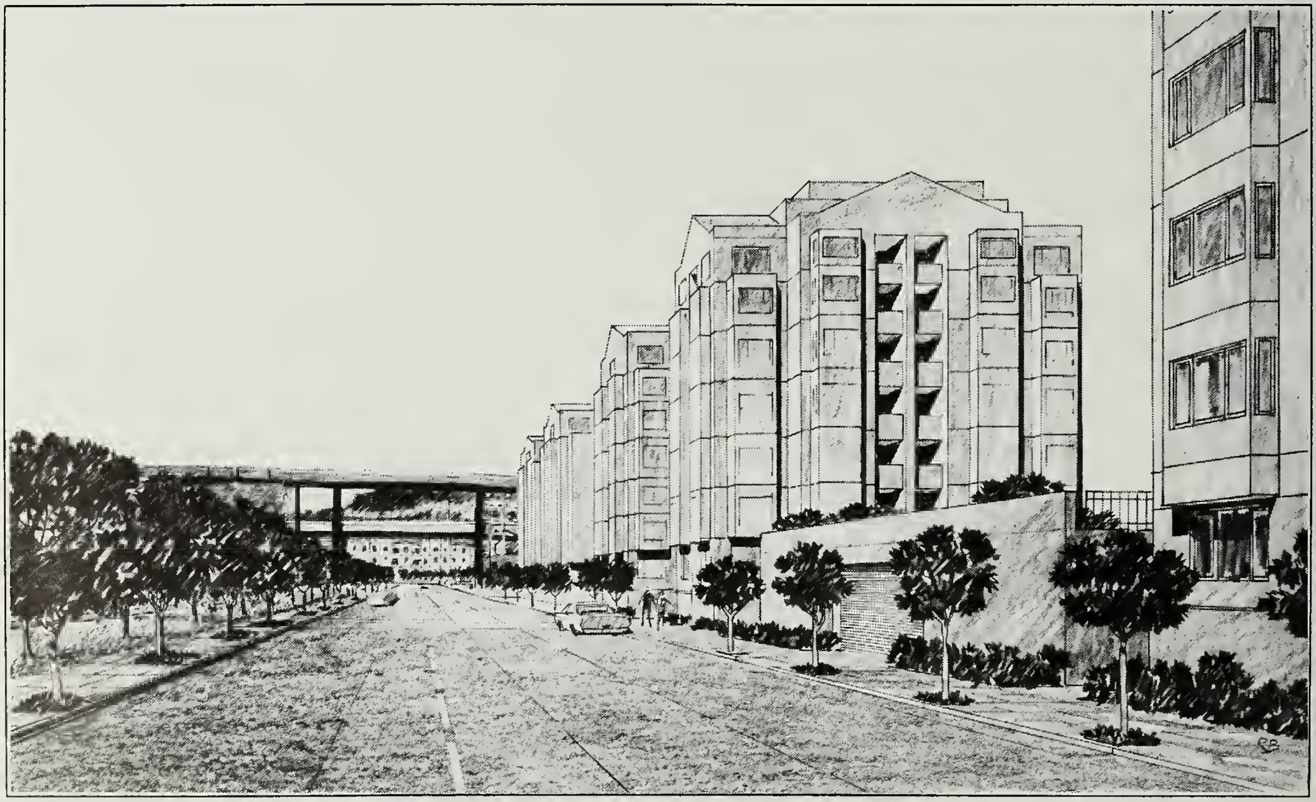
The new buildings would obscure existing views to the south and west of Potrero Hill and Twin Peaks, except for limited views down Berry Street itself and between new buildings. The Sixth Street freeway ramps would be visible beyond the new buildings, over Berry Street. Three-story S/LI/RD buildings would appear beyond the freeway near Seventh Street. The new sidewalks along Berry Street would be landscaped and relatively wide, with parking and ground-floor conditions as described for the Third and Townsend Streets viewpoint i.e., areas of blank walls, separating building entrances.

Alternative B. Berry Street with Alternative B would include medium-high density residential buildings on the north (see Figure VI.I.7). As with Alternative A, views and shading of the freeway structure over Berry Street would be eliminated. The south side would be open space extending to China Basin Channel. West of Sixth Street would be additional residential buildings which would partially block the view down Berry Street under the Sixth Street freeway ramps. The open space proposed south of Berry Street would enhance pedestrian views to the south toward Potrero Hill and the channel, and increase sunlight access to open space and residential courtyards of buildings to the north.

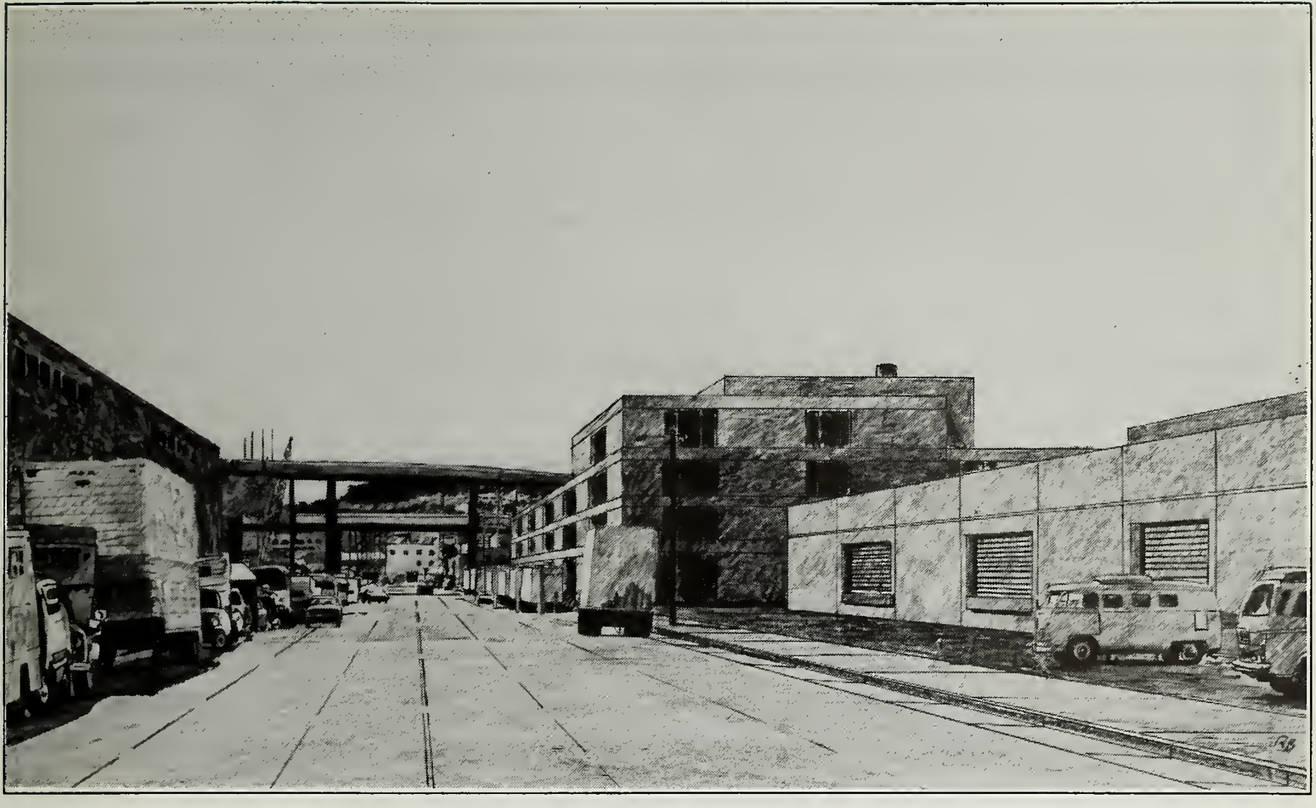
Alternative N. Berry Street, as defined in Alternative N, would include views of industrial buildings (see Figure VI.I.7). The uses could be served by railroad



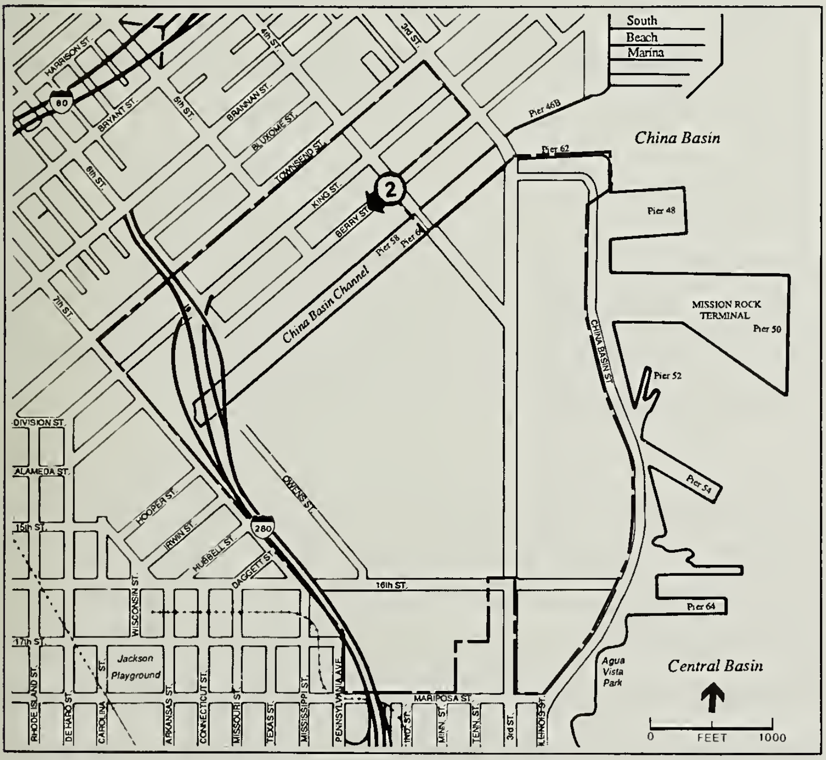
ALTERNATIVE A: Berry Street near Fourth Street (Viewpoint 2)



ALTERNATIVE B: Berry Street near Fourth Street (Viewpoint 2)



ALTERNATIVE N: Berry Street near Fourth Street (Viewpoint 2)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NOTE: The illustrations are building mass and view studies that incorporate conservative height and bulk assumptions to present a reasonable worst-case scenario of street-level views. The illustrations are not renderings of specific building designs, and do not represent the pedestrian or vehicular activity that may occur in the viewpoints.

FIGURE VI.I.7
ILLUSTRATION OF ALTERNATIVES -
VIEWPOINT 2: BERRY STREET NEAR FOURTH STREET

SOURCE: Roger Owen Boyer and Associates

tracks. As discussed for Alternatives A and B, the freeway structure would be removed. The new buildings would obscure most of the existing view of Potrero Hill and Twin Peaks now visible beyond the Sixth Street freeway ramps. Views down Berry Street itself and between new buildings would remain. New sidewalks on Berry Street would be expected to have few pedestrian amenities and little landscaping, similar to other industrial areas.

Viewpoint 3 - China Basin Channel Near Fourth Street

Alternative A. Views westerly along China Basin Channel near Fourth Street would include eight-story residential buildings, replacing the I-280 stub, north of the channel with retail uses and terraces fronting on landscaped open space (see Figure VI.I.8, p. VI.I.47) The channel edge would be lined with intermittent wood decks built over the water. Other parts of the shoreline would be landscaped gabions (rock fill) or T-walls (visible as vertical concrete walls) to retain the bank. Those improvements would replace views of the existing concrete rubble, rock and mud shoreline of the channel.

Visible at the westerly end of the channel would be the existing houseboat community and Sixth Street ramps of I-280. South of the channel would be open space, extending continuously from the Bay to the railroad tracks between Owens and Seventh Streets. South of the open space, not visible in Figure VI.I.8, would be six-story and eight-story MDR and MHDR buildings.

Residential buildings north of the channel would obscure the view of Twin Peaks and Sutro Tower. Potrero Hill would remain partially visible beyond the existing Sixth Street freeway ramps. With the I-280 stub removed, open space on both sides of the channel would provide an enhanced pedestrian environment.

Alternative B. Views along the north side of the channel near Fourth Street would include major open space south of Berry Street on land available after demolition of the I-280 stub (see Figure VI.I.8, p. VI.I.47). North of Berry Street would be six- to eight-story residential buildings. The channel shoreline open space would be developed with pathways and landscaping. The existing houseboat community and the Sixth Street ramp would remain visible. South of the channel would be open space with a new wetlands, providing views of a curvilinear shoreline of marsh grass, with mudflats at low tide. South of Hooper Street would be additional open space and residential buildings.

New buildings north of Berry Street would obscure the existing partial view of Twin Peaks. Only the upper portion of Sutro Tower would remain visible, as would Potrero Hill beyond the Sixth Street freeway ramps. The open space in Alternative B would provide an enhanced pedestrian environment near the channel and south of Hooper.

Alternative N. Views along China Basin Channel with Alternative N would generally include industrial buildings (see Figure VI.I.8). After demolition of the I-280 freeway stub, the area north of the channel would be developed with two- to four-story industrial uses. The existing houseboat community and the Sixth Street ramps would remain. Views south of the channel would also include industrial buildings.

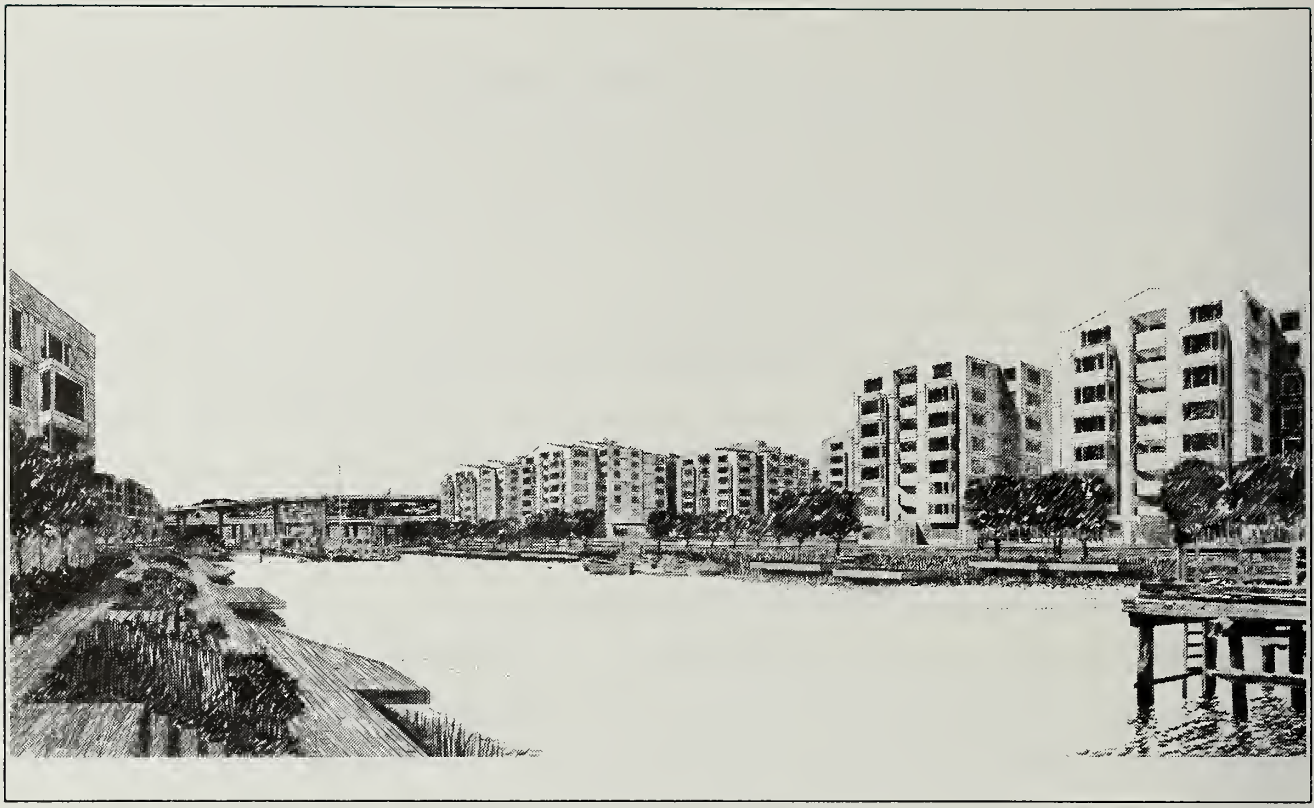
The new buildings and uses would obscure the existing view of Twin Peaks; the upper portion of Sutro Tower and Potrero Hill would remain partially visible beyond the Sixth Street ramps. New open space about 25 feet wide would be provided on each side of the channel with pathways along the water; channel embankments would be similar to existing conditions. Because of industrial uses, the pedestrian areas along the channel would have few amenities.

Viewpoint 4 - Third, Fourth and Mission Rock Streets

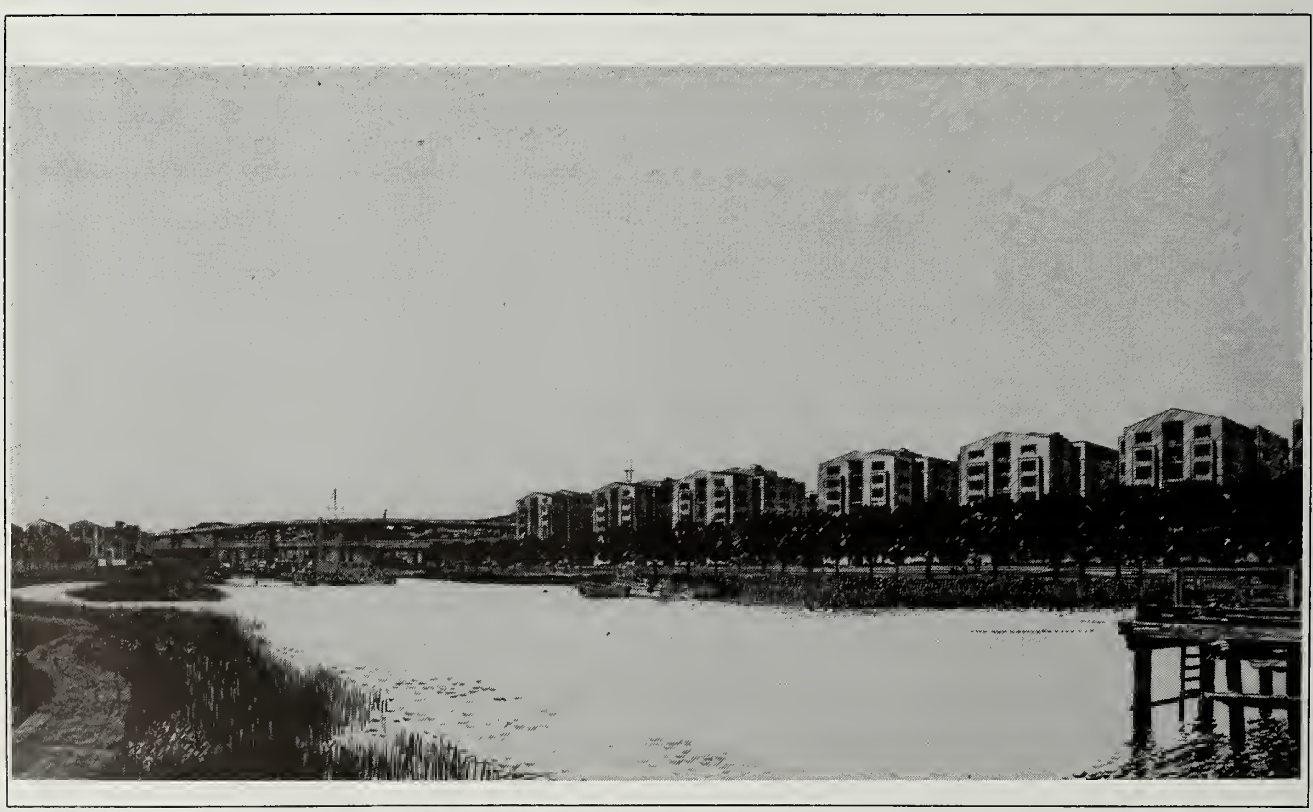
Alternative A. Views north on Third and Fourth Streets with Alternative A would include an eight-story hotel, six-story residential buildings west of Third Street and a six-story community facility with open space east of Third Street (see Figure VI.I.9, p. VI.I.48). The hotel would be oriented to allow upper floor rooms to have views of the Bay and downtown San Francisco. The hotel site would include street-level features such as entrance areas and retail uses. At-grade parking would be visible from the street.

From this viewpoint, new buildings would obscure most of the existing views of the China Basin Building and downtown San Francisco; the two drawbridges would remain visible. Pedestrian streetscape conditions would include widened sidewalks and landscaping. Third Street would have hotel activity and retail shops on the west side and open space with views to the Bay on the east. The eight-story hotel would have a horizontal orientation, similar to the height and orientation of the China Basin Building and would be larger in scale than nearby residential buildings.

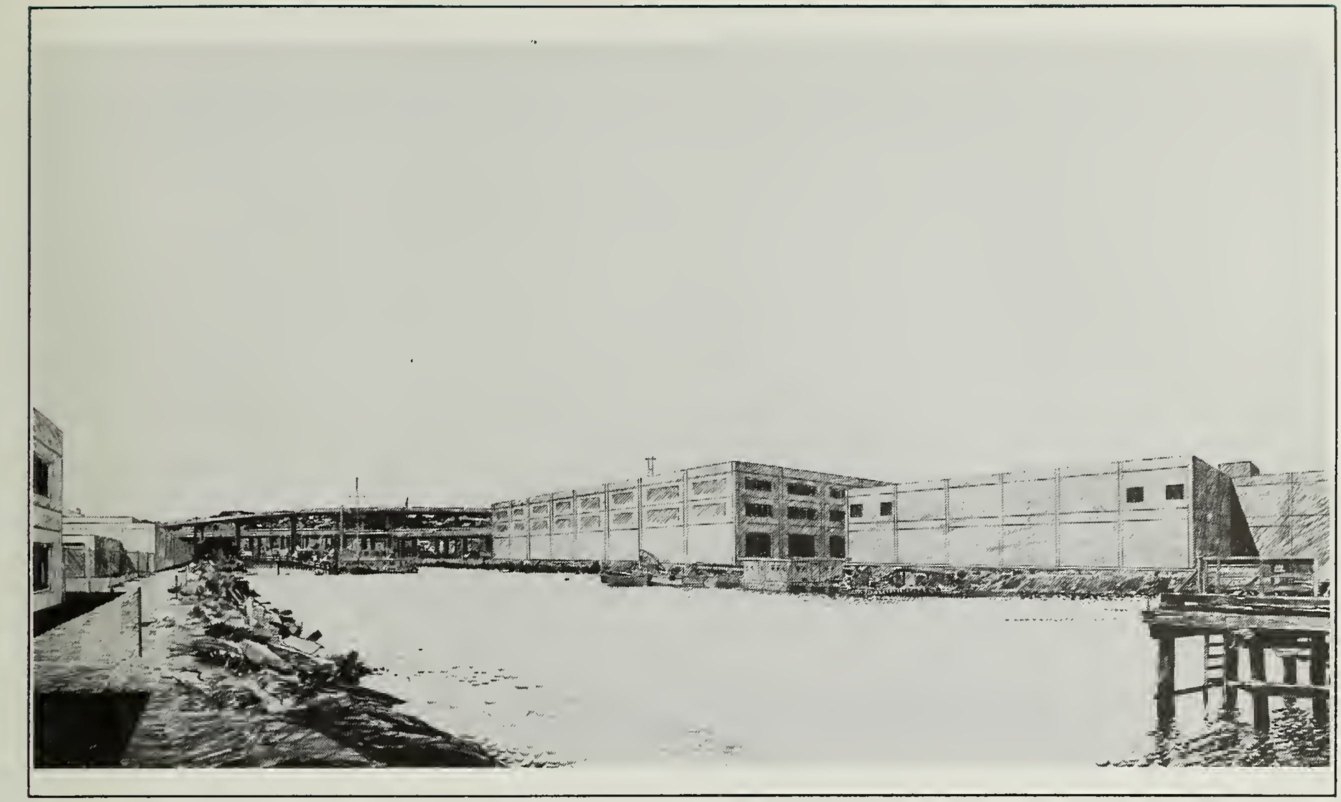
Alternative B. With Alternative B, views north on Third and Fourth Streets from open space between Third and Fourth Streets would include the downtown skyline and the China



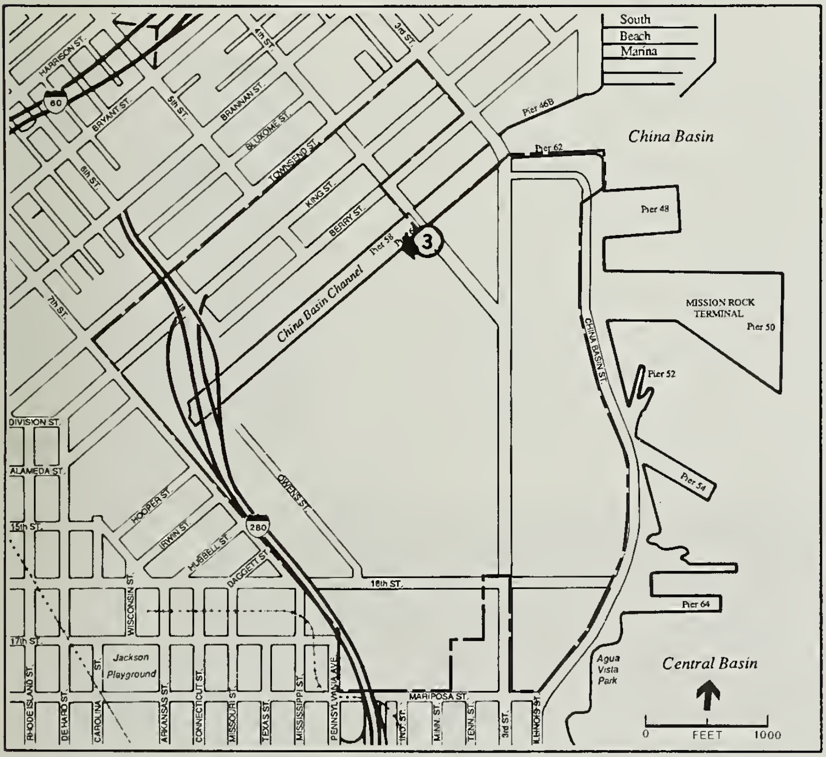
ALTERNATIVE A: China Basin Channel near Fourth Street (Viewpoint 3)



ALTERNATIVE B: China Basin Channel near Fourth Street (Viewpoint 3)



ALTERNATIVE N: China Basin Channel near Fourth Street (Viewpoint 3)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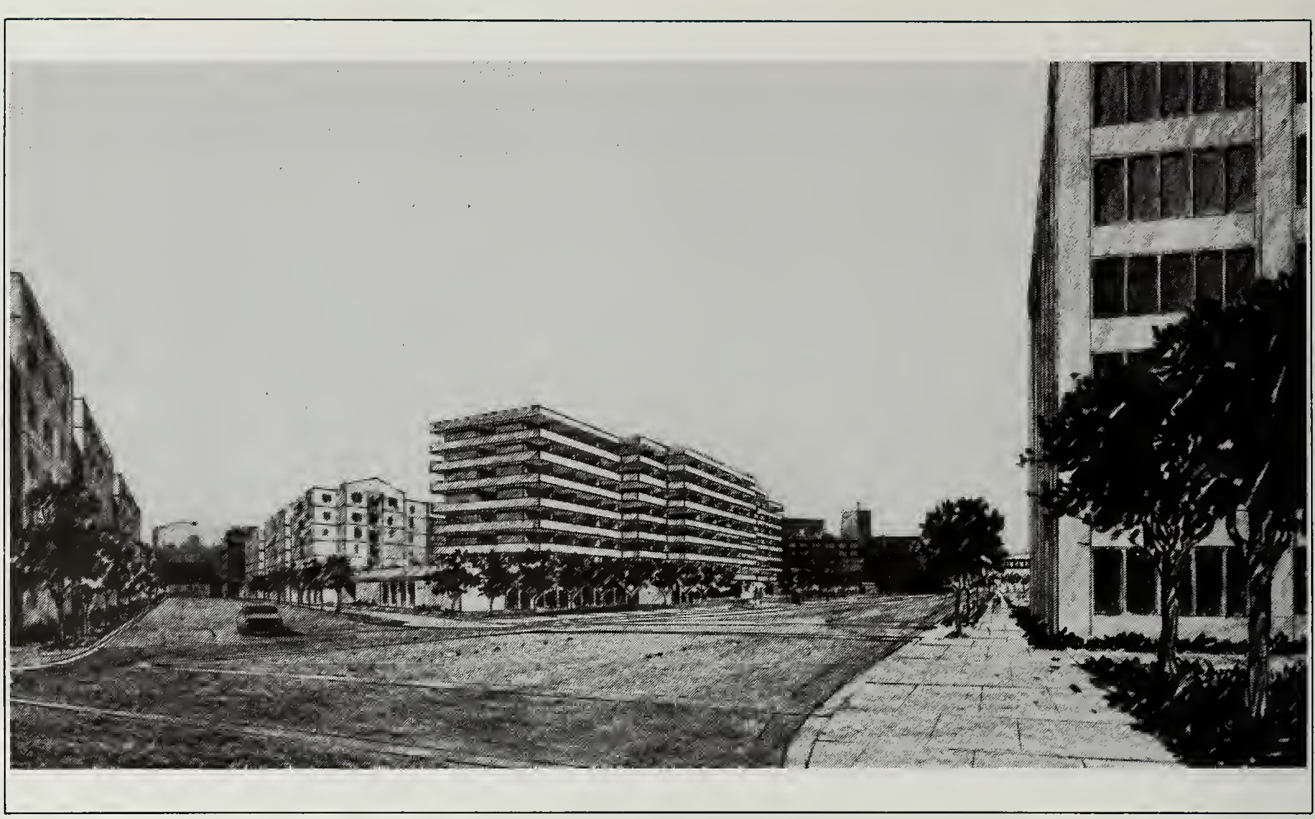
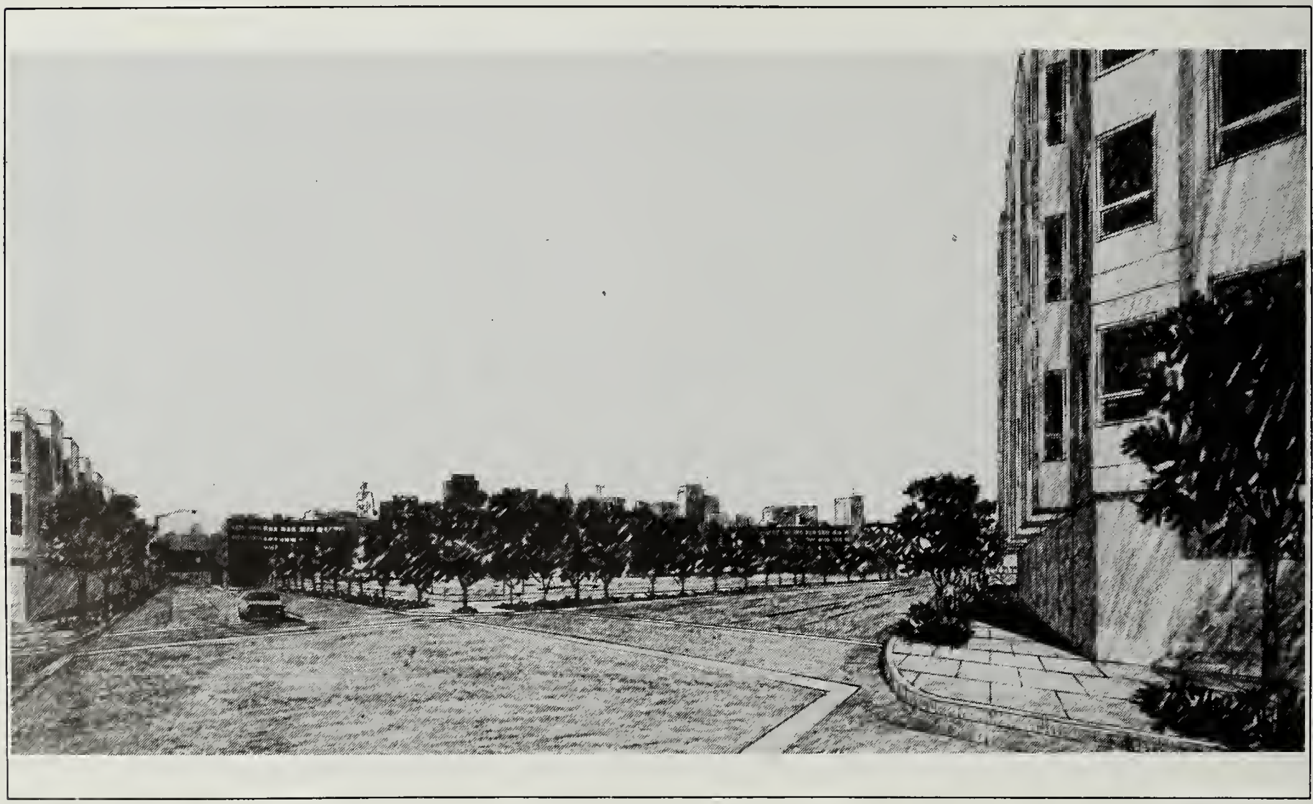
NOTE: The illustrations are building mass and view studies that incorporate conservative height and bulk assumptions to present a reasonable worst-case scenario of street-level views. The illustrations are not renderings of specific building designs, and do not represent the pedestrian or vehicular activity that may occur in the viewpoints.

FIGURE VI.I.8
ILLUSTRATION OF ALTERNATIVES -
VIEWPOINT 3: CHINA BASIN CHANNEL NEAR FOURTH STREET

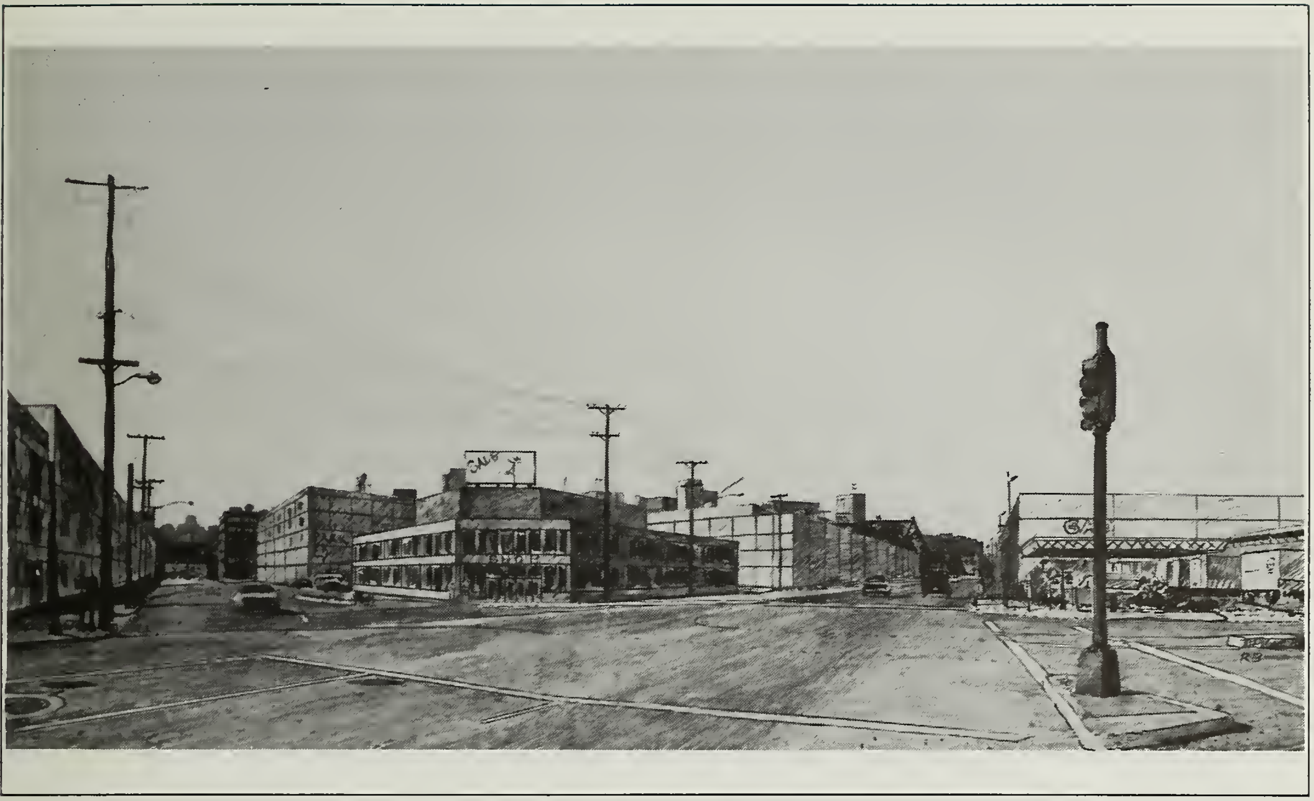
SOURCE: Roger Owen Boyer and Associates



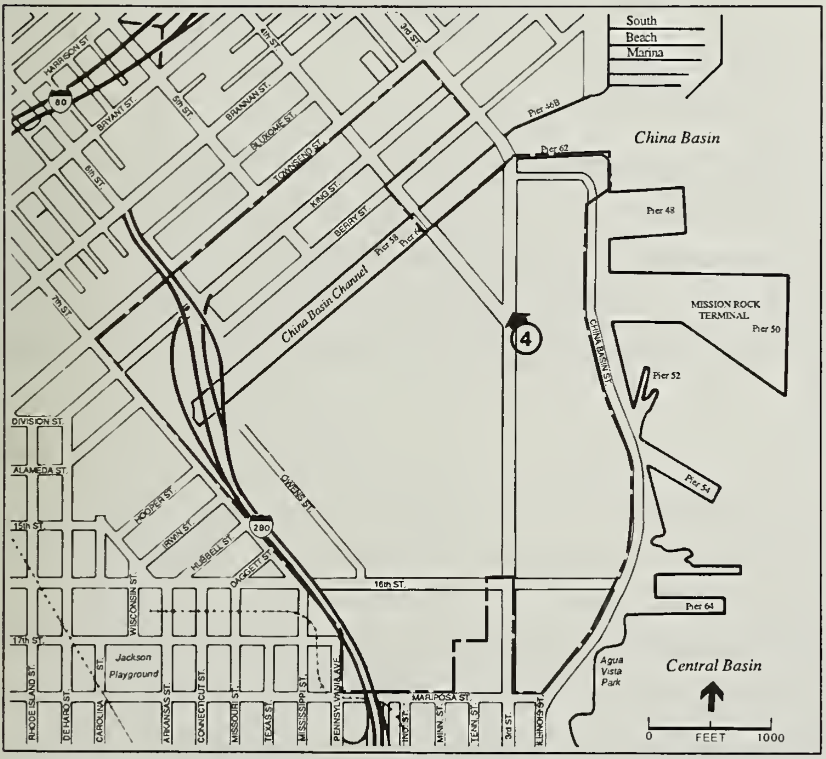
ALTERNATIVE A: Third, Fourth and Mission Rock Streets (Viewpoint 4)



ALTERNATIVE B: Third, Fourth and Mission Rock Streets (Viewpoint 4)



ALTERNATIVE N: Third, Fourth and Mission Rock Streets (Viewpoint 4)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NOTE: The illustrations are building mass and view studies that incorporate conservative height and bulk assumptions to present a reasonable worst-case scenario of street-level views. The illustrations are not renderings of specific building designs, and do not represent the pedestrian or vehicular activity that may occur in the viewpoints.

Mission Bay

SOURCE: Roger Owen Boyer and Associates

FIGURE VI.I.9
ILLUSTRATION OF ALTERNATIVES - VIEWPOINT 4: THIRD, FOURTH AND MISSION ROCK STREETS

Basin Building (see Figure VI.1.9, p. VI.I.48). West of Fourth Street would be three- to four-story, low-density residential buildings. East of Third Street would be medium-density residential uses, up to six stories, and open space. The open space which would include new wetlands east of Third Street would provide views of parks, the Bay and downtown.

Alternative N. The view north from Third and Fourth Streets with Alternative N would have a two-story retail building on the Banana Triangle area, and retail uses with surface parking and loading docks north of the building (see Figure VI.1.9, p. VI.1.49). To the west would be one- and two-story tilt-up concrete buildings for warehouse and light industrial uses. East of Third Street would include new infill buildings among existing industrial buildings.

The new buildings and uses would obscure most of the existing view of downtown San Francisco and the China Basin Building. The views down Third and Fourth Streets to the drawbridges would remain. Sidewalks would be expected to have minimal pedestrian amenities with little or no landscaping.

Viewpoint 5 - Former Southern Pacific Railyards

Alternative A. Views northerly along extended Minnesota Street from the proposed Central Square would include the center of a neighborhood of four- to five-story residential buildings with street-level retail uses (see Figure VI.1.10, p. VI.1.52). The new buildings would reduce, but not eliminate, the existing view of downtown San Francisco and the China Basin Building. The two-acre plaza and adjacent retail uses would provide a pedestrian-oriented streetscape.

Alternative B. The northerly view from Hubbell Street would be between two residential buildings separated by 125-foot-wide open space corridor, part of a continuous open space system from the Bay to China Basin Channel in Alternative B (see Figure VI.I.10, p. VI.1.52). LDR and MDR would bound the major open space south of the channel. MHDR uses would be visible north of the channel. Views of downtown San Francisco and the China Basin Building would remain, depending on placement of landscaping in the open space.

Alternative N. Views northerly along a secondary street would include industrial buildings two- to four-stories high (see Figure VI.I.10, p.VI.1.53). The buildings would reduce the existing view of downtown San Francisco and China Basin Building. The downtown skyline would be visible above the industrial buildings. Because of the industrial uses with this Alternative, the pedestrian areas along this street would have few amenities and little landscaping.

Viewpoint 6 – Owens Street North of 16th Street

Alternative A. The view north on Owens Street would be of two- to four-story S/LI/RD buildings to the west and six- to eight-story MHDR buildings to the east (see Figure VI.I.11, p. VI.I.54). From street level, new buildings would obscure views of I-280 and downtown San Francisco except for views down Owens Street itself. Both sides of Owens would include street landscaping.

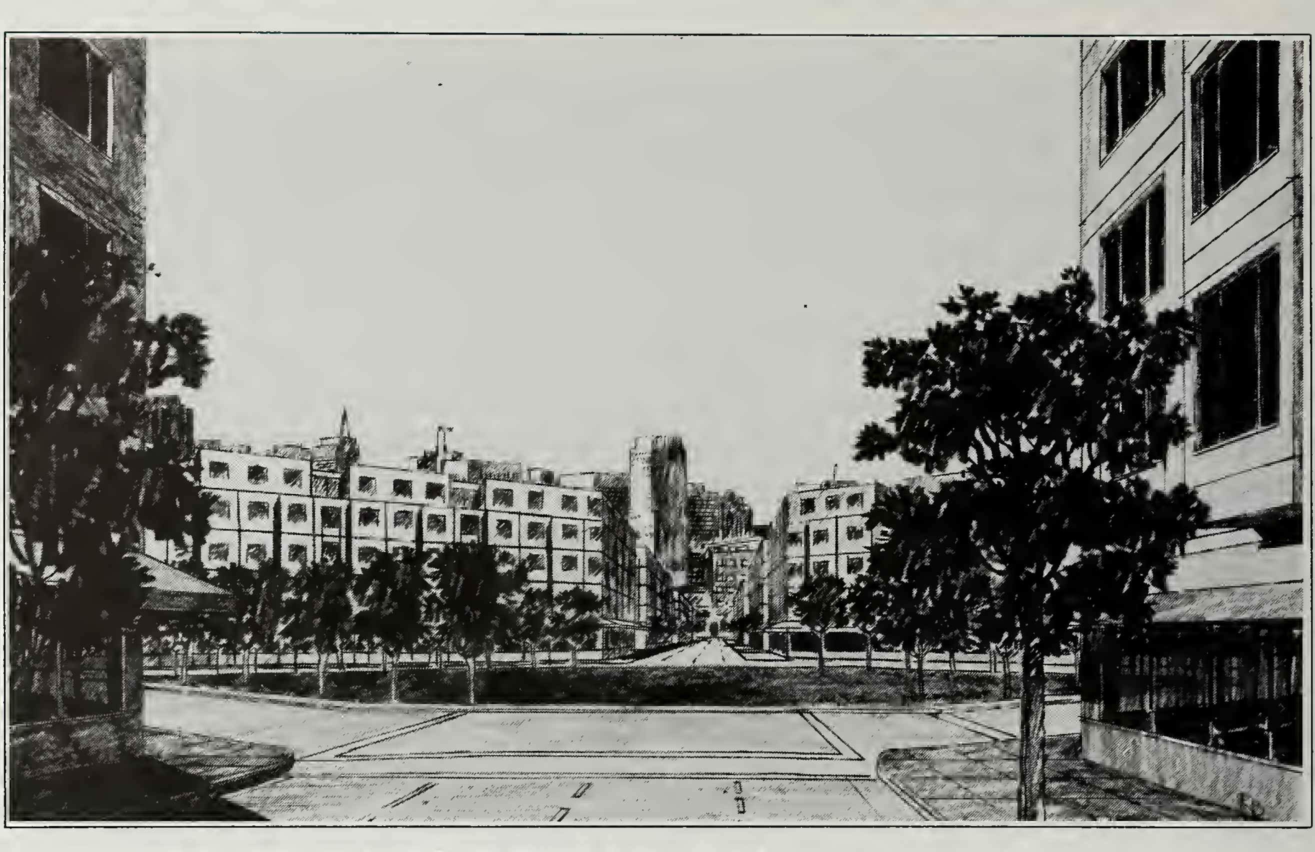
Alternative B. The view north on Owens Street would include six- to eight-story office buildings to the west and six-story MDR buildings to the east (see Figure VI.I.11, p. VI.I.54). From this viewpoint, new buildings would obscure views of I-280 and downtown San Francisco except for the view north on Owens Street itself. Both sidewalks would include trees and landscaping.

Alternative N. Views north on Owens Street would include one- to four-story industrial buildings on the west and east, for warehouse and light industrial uses (see Figure VI.I.11, p. VI.I.55). The existing warehouse on the east side would probably remain. Further north would be other industrial buildings. New buildings would obscure most of the existing views of downtown San Francisco and I-280. Pedestrian amenities would be expected to be minimal, with conditions similar to those in other industrial areas.

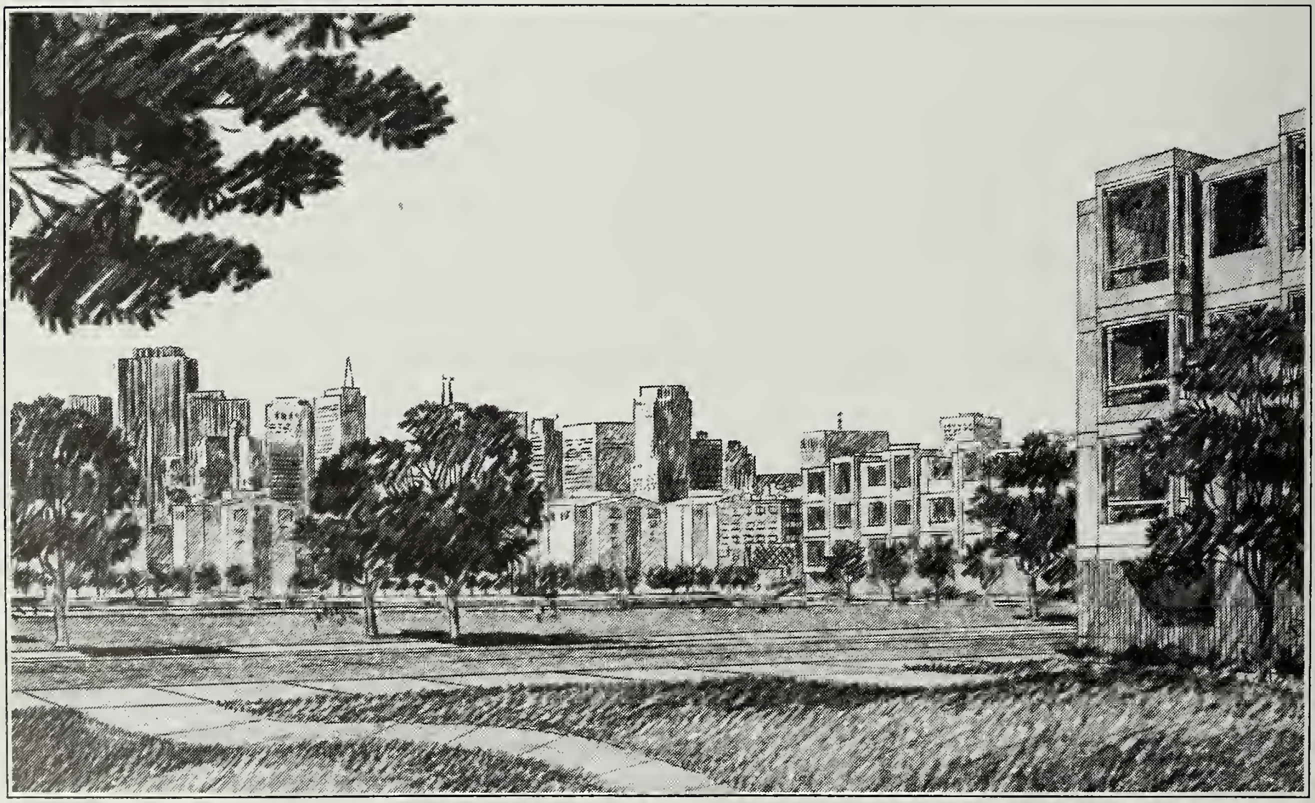
SHADOW

Build-Out/2020

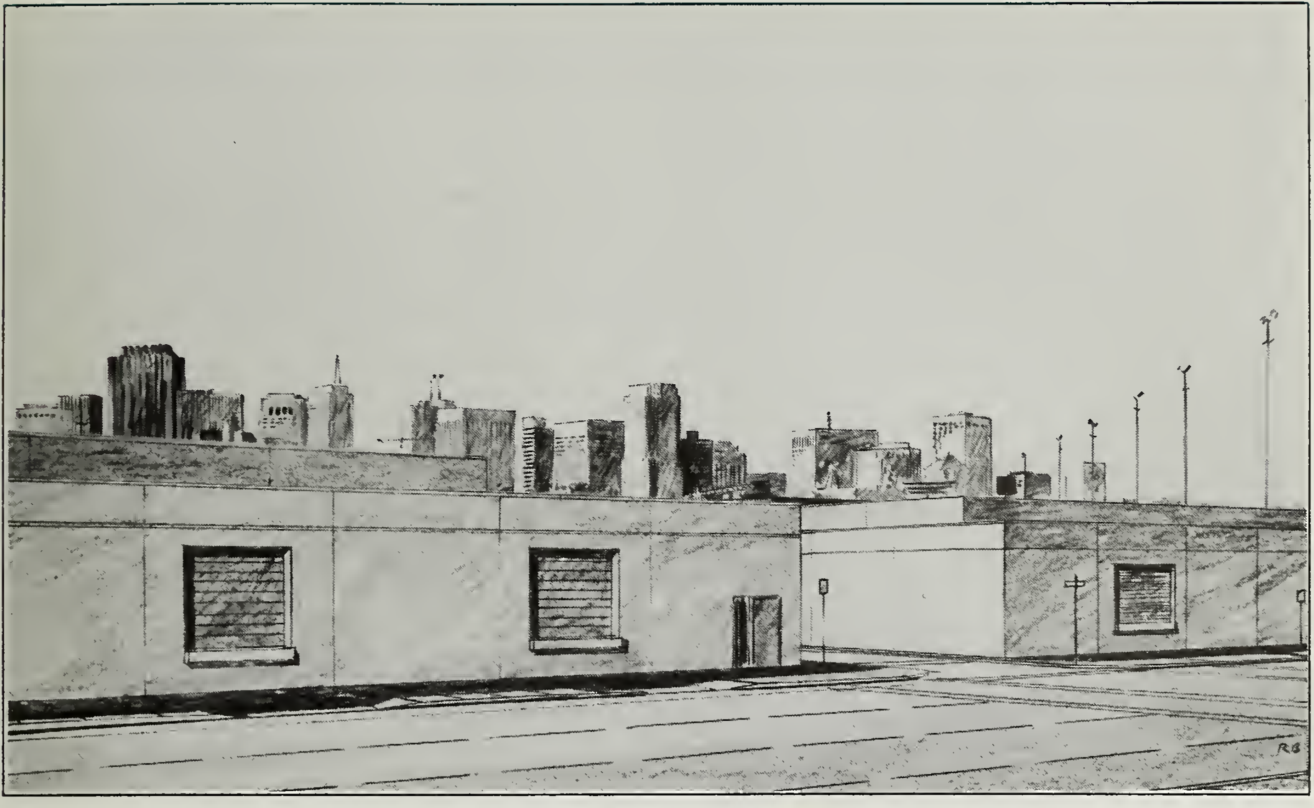
New buildings in Mission Bay could potentially shade public open space proposed under each Alternative. The extent and duration of shadows cast would depend on the actual design, height, bulk, and lot placement and coverage of each specific structure. Because such detail is not available now, generalized building massings for each land use were used to estimate the maximum shading potential for various land uses. The analysis is necessarily general in nature, but presents an order-of-magnitude estimate of the worst-case shadow impacts; actual shadow effects would be expected to be less than



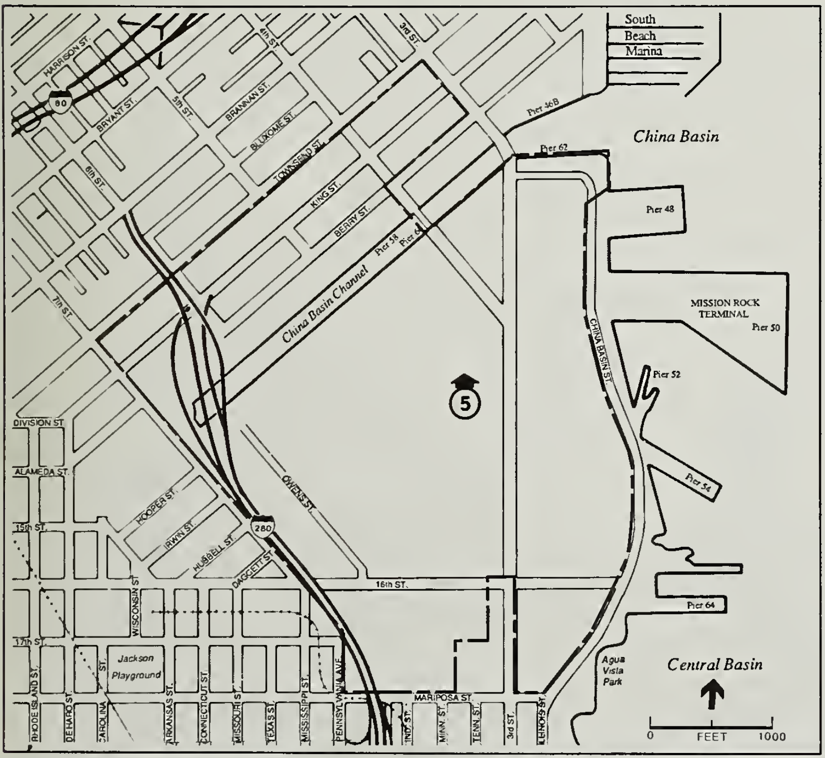
ALTERNATIVE A: Former Southern Pacific Railyards (Viewpoint 5)



ALTERNATIVE B: Former Southern Pacific Railyards (Viewpoint 5)



ALTERNATIVE N: Former Southern Pacific Railyards (Viewpoint 5)

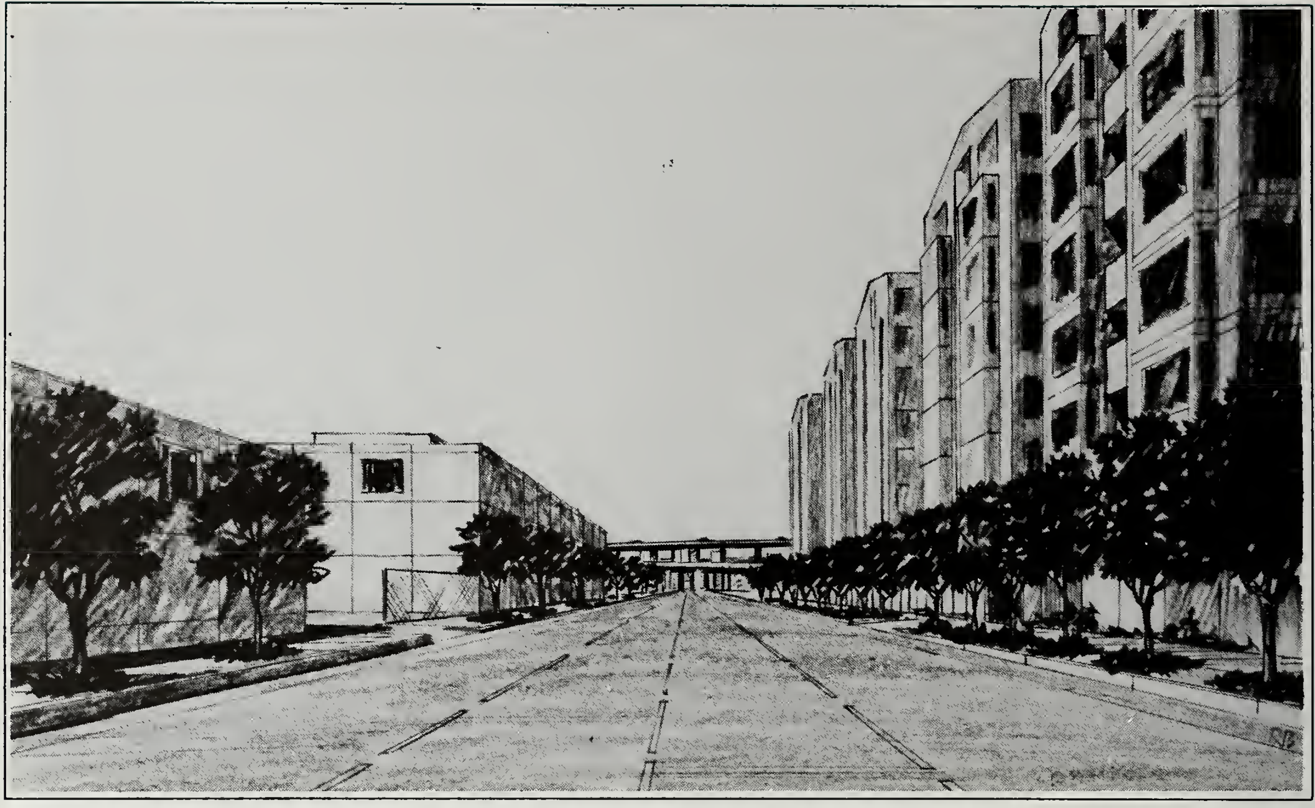

South
Beach
Marina
China Basin
HARRISON ST.
80
BRYANT ST.
4th ST.
3rd ST.
5th ST.
BRANNAN ST.
BLUXOME ST.
TOWNSEND ST.
6th ST.
KING ST.
BERRY ST.
Pier 46B
Pier 62
Pier 48
Pier 58
Pier 64
7th ST.
China Basin Channel
MISSION ROCK TERMINAL
Pier 50
CHINA BASIN ST.
Pier 52
5
DIVISION ST.
ALAMEDA ST.
OWENS ST.
Pier 54
HOOPER ST.
15th ST.
IRWIN ST.
280
HUBBELL ST.
DAGGETT ST.
16th ST.
Pier 64
WISCONSIN ST.
17th ST.
Jackson Playground
ST.
Agua Vista Park
Central Basin
RHODE ISLAND ST.
DEHARO ST.
CAROLINA
ARKANSAS ST.
CONNECTICUT ST.
MISSOURI ST.
TEXAS ST.
MISSISSIPPI ST.
PENNSYLVANIA AVE.
MARIPOSA ST.
IND. ST.
MINN. ST.
TENN. ST.
3rd ST.
ILLINOIS ST.
0
FEET
1000

NOTE: The illustrations are building mass and view studies that incorporate conservative height and bulk assumptions to present a reasonable worst-case scenario of street-level views. The illustrations are not renderings of specific building designs, and do not represent the pedestrian or vehicular activity that may occur in the viewpoints.

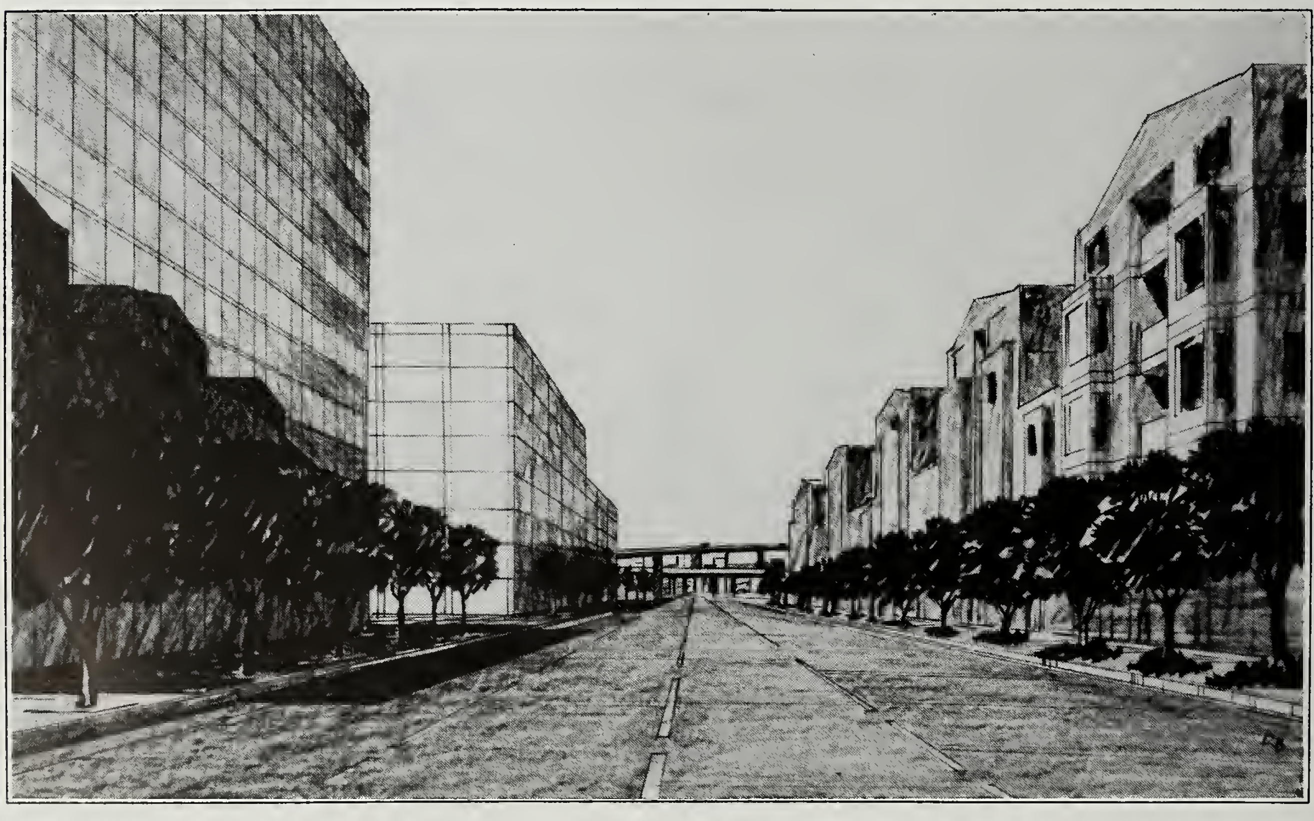
Mission Bay

SOURCE: Roger Owen Boyer and Associates

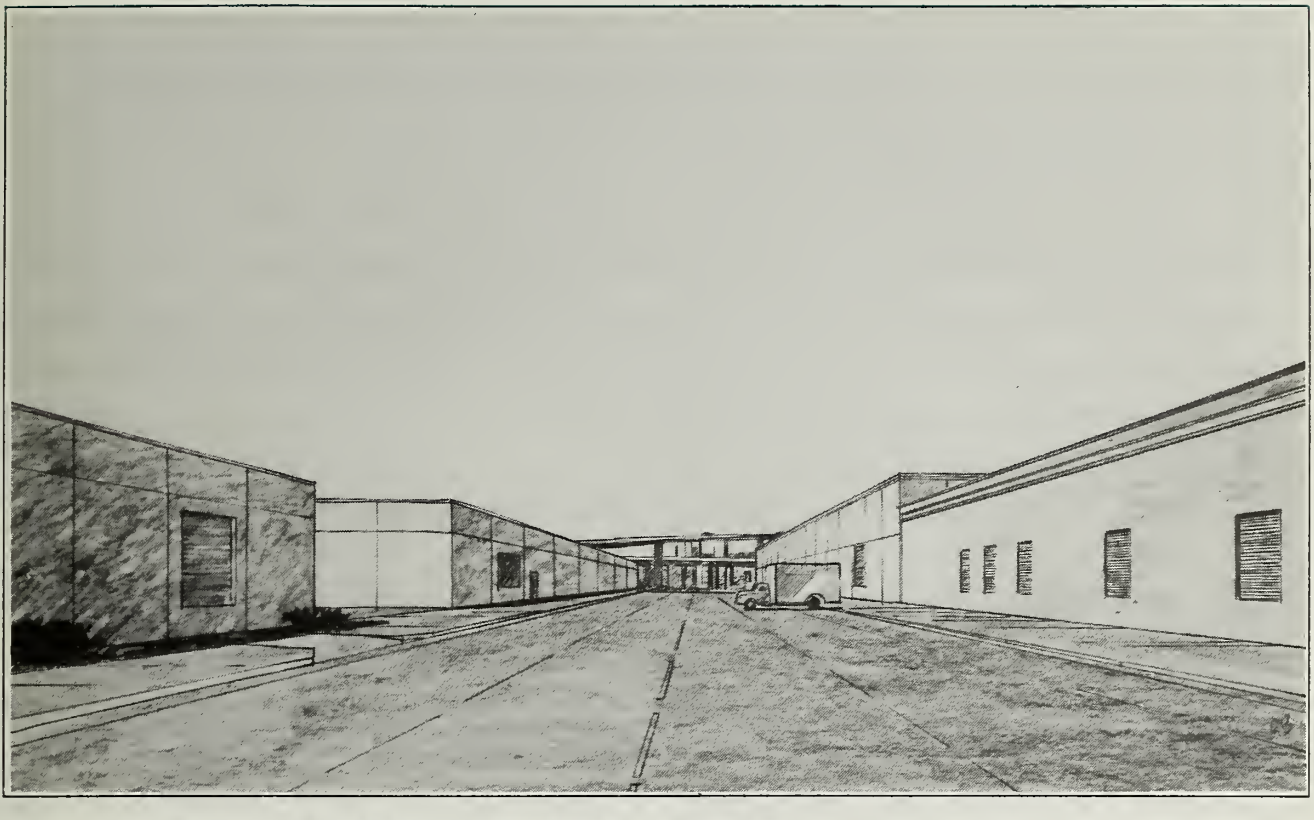
FIGURE VI.I.10
ILLUSTRATION OF ALTERNATIVES -
VIEWPOINT 5: FORMER SOUTHERN PACIFIC RAILYARDS



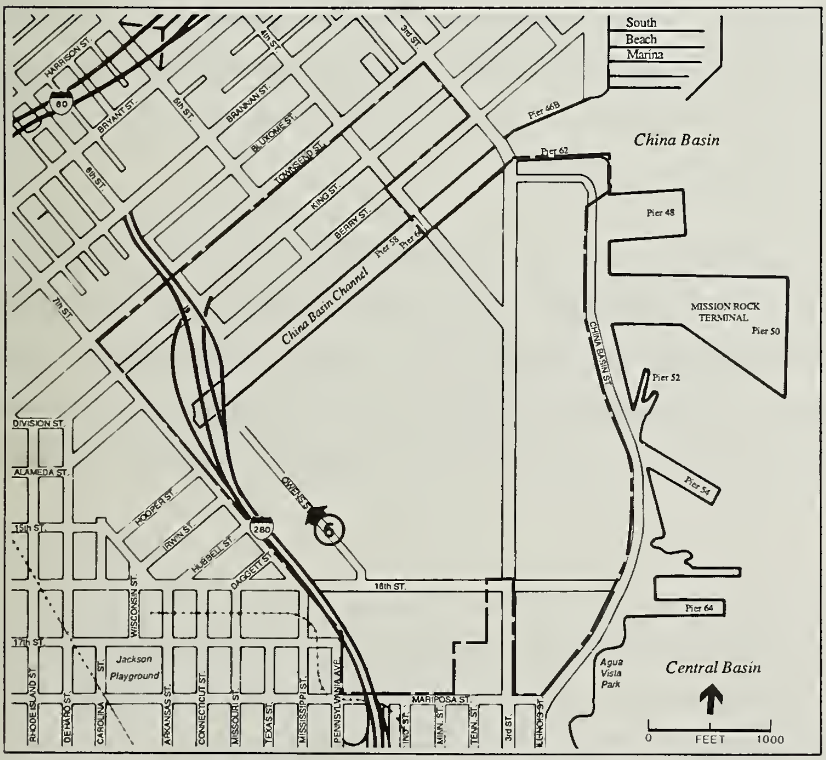
ALTERNATIVE A: Owens Street North of 16th Street (Viewpoint 6)



ALTERNATIVE B: Owens Street North of 16th Street (Viewpoint 6)



ALTERNATIVE N: Owens Street North of 16th Street (Viewpoint 6)


South Beach Marina
China Basin
HARRISON ST.
80
BRYANT ST.
5th ST.
4th ST.
3rd ST.
BRANNAN ST.
BLUXOME ST.
TOWNSEND ST.
KING ST.
BERRY ST.
6th ST.
7th ST.
Pier 46B
Pier 62
Pier 48
Pier 58
Pier 60
China Basin Channel
MISSION ROCK TERMINAL
Pier 50
Pier 52
CHINA BASIN ST.
Pier 54
Pier 64
DIVISION ST.
ALAMEDA ST.
15th ST.
HOOPER ST.
IRWIN ST.
HUBBELL ST.
DAGGETT ST.
280
OWENS ST.
6
16th ST.
17th ST.
WISCONSIN ST.
Jackson Playground
RHODE ISLAND ST.
DE HARO ST.
CAROLINA ST.
ARKANSAS ST.
CONNECTICUT ST.
MISSOURI ST.
TEXAS ST.
MISSISSIPPI ST.
PENNSYLVANIA AVE.
IND. ST.
MINN. ST.
TENN. ST.
3rd ST.
ILLINOIS ST.
MARIPOSA ST.
Agua Vista Park
Central Basin
0 FEET 1000

NOTE: The illustrations are building mass and view studies that incorporate conservative height and bulk assumptions to present a reasonable worst-case scenario of street-level views. The illustrations are not renderings of specific building designs, and do not represent the pedestrian or vehicular activity that may occur in the viewpoints.

SOURCE: Roger Owen Boyer and Associates

FIGURE VI.I.11
ILLUSTRATION OF ALTERNATIVES -
VIEWPOINT 6: OWENS STREET NORTH OF 16TH STREET

those discussed below./13/ The shadow analysis reviews Build-out/2020 conditions, when development would have greatest potential effects on open space, and development of proposed open spaces would be complete.

Shadows were examined for morning (10 a.m.), noon, and afternoon (3 p.m.) for each of four conditions: winter and summer solstices when the sun is at its lowest and highest in the sky (and shadows are then the longest and shortest, respectively) and the spring and fall equinoxes when shadows are of intermediate length. The 10 a.m. to 3 p.m. times represent periods when maximum use of open space generally would occur. Shadow coverage would be greater before 10 a.m. and after 3 p.m.

The Sunlight Ordinance (Proposition K), an initiative approved in 1984, prohibits the issuance of building permits for structures above 40 feet in height that would generate significant shadow impacts on property under the jurisdiction of, or designated to be acquired by, the Recreation and Park Commission, between one hour after sunrise and one hour before sunset at any time of year. A permit may be issued if the City Planning Commission, in consultation with the Recreation and Park Commission, determines that such shadow would have an insignificant adverse impact on the use of such property. The ordinance does not apply to new structures 40 feet or less in height, nor to structures that existed before its passage; site redevelopment that is within the building envelope dimensions of former structures would also be exempt.

Ownership of or jurisdiction over open space proposed in the Mission Bay Alternatives, and therefore the applicability of the Sunlight Ordinance, has not been determined. In light of the possibility that jurisdiction over open space in Mission Bay might be transferred to the Recreation and Park Commission, the analyses below also briefly characterize shadow effects on Project Area open space in relation to the 40-foot height criterion for each Alternative.

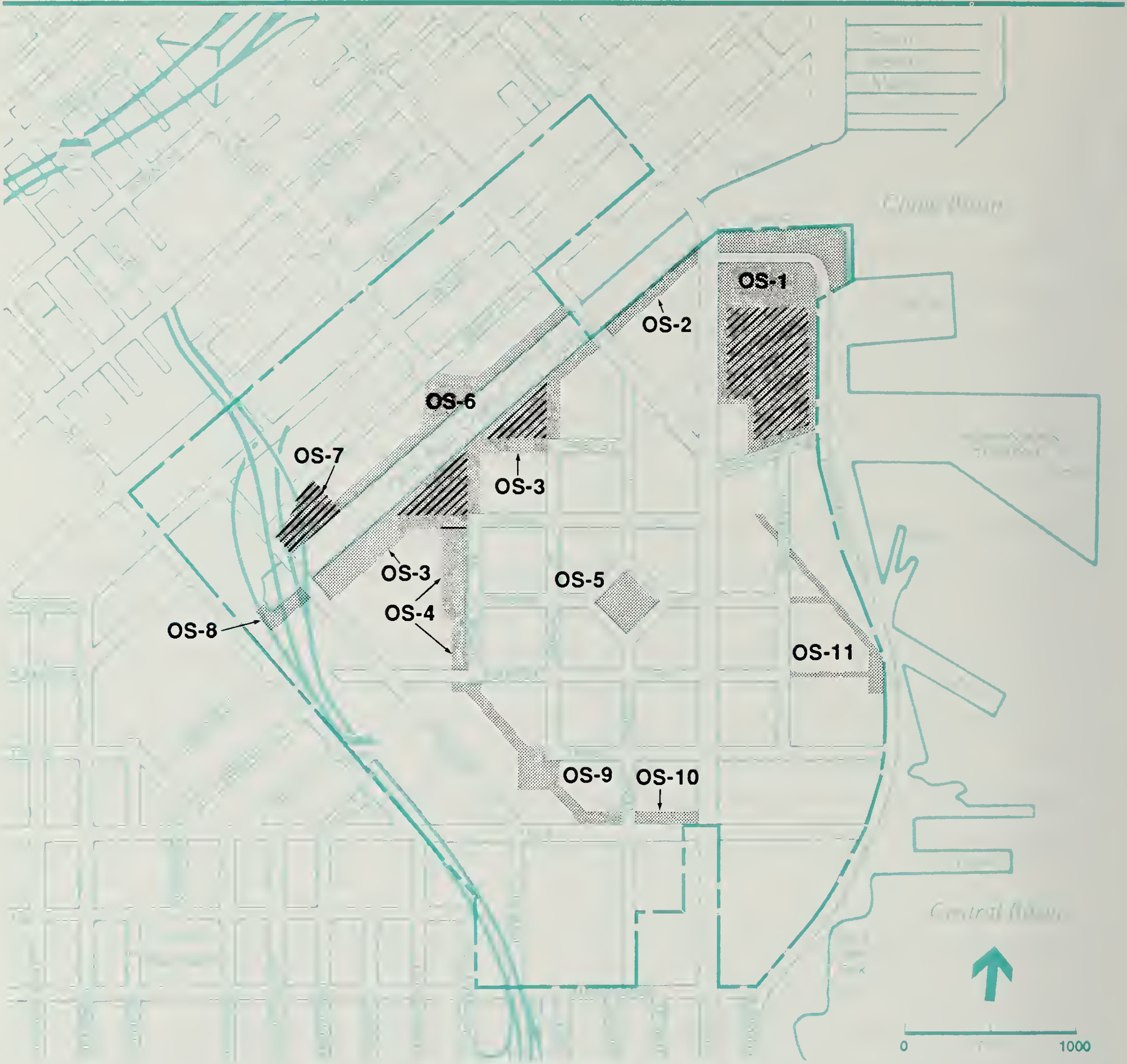
The nearest existing or proposed public open space outside the Project Areas are South Park in the center of the block bounded by Second, Third, Bryant, and Brannan Streets (about 1,000 feet north of the Project Area), open space at the South Beach Marina near the foot of Berry Street (about 1,000 feet northeast of the Project Area), and a recreation center on the northwest corner of Sixth and Folsom Streets (about 2,700 feet northwest of the Project Area, currently under construction). Mission Bay buildings would not shade any of these areas between one hour after sunrise and one hour before sunset at any time of year. Plazas, courtyards, and other private open space areas in the new development adjacent to the Project Area could be subject to shading. Smaller, publicly accessible open space associated with housing, office, and S/LI/RD uses in Mission Bay would also be subject to shading by adjacent structures. Proposed Project Area open spaces would provide opportunities for active and for passive recreation. While both types of use could potentially be adversely affected, shading and lower temperatures could be expected to have a relatively greater impact on passive uses such as sitting or picnicking. Wetlands (under Alternative B) would not be affected. Mission Bay buildings would shade major Project Area public open space as described below.

The shadow discussion divides open space proposed with each Alternative into major open space units. Grouping of open space areas into larger units with related similar orientation and location simplifies the presentation of the shadow analysis. VI.D. Community Services and Infrastructure, Recreation and Parks, pp. VI.D.61-VI.D.86, discusses open space areas and uses for each Alternative. For each Alternative, this section generally describes the open space units and the sources, times and extent of shadow. Table VI.I.3, p. VI.I.59, Table VI.I.4, p. VI.I.64 and Table VI.I.5, p. VI.I.68 summarize shading of open space units for the three times of day on the solstices and equinoxes.

As discussed on p. VI.I.31, the Alternative N scenario anticipates M-2 buildings up to four stories high, with office buildings up to eight stories in the Third and Townsend block. Existing height limits in portions of the Project Area range from 80 to 200 feet, which could permit buildings up to 16 stories which would cast longer shadows (see Chapter V. The EIR Alternatives and Approval Process, pp. V.A.16-V.A.17, for a discussion of Alternative N land use assumptions).

Alternative A

Figure VI.I.12, illustrates Alternative A open space and shows open space units. Table VI.I.3, p. VI.I.59, summarizes shadow coverage for Alternative A and shows percent of each unit or combination of units of open space covered by building shadow. Percent of


China Basin
OS-1
OS-2
OS-6
OS-7
OS-3
OS-3
OS-4
OS-5
OS-8
OS-11
OS-9
OS-10
Central Basin
0
1000

— — MISSION BAY BOUNDARY

▨ ACTIVE SPORTS AREA
(non-hatched open space areas are passive open space)

OPEN SPACE PROVIDED BY 2000	
OS-1	16.5 ACRES
OS-2	1.6 ACRES
OS-3	10.8 ACRES
OS-4	2.5 ACRES
OS-5	2.0 ACRES

OPEN SPACE PROVIDED AFTER 2000 AND BY 2020	
OS-6	3.0 ACRES
OS-7	1.0 ACRE
OS-8	0.5 ACRE
OS-9	3.4 ACRES
OS-10	0.4 ACRE
OS-11	1.6 ACRES

NOTE: This figure does not show additional open space that would be included with housing, office and S/LI/RD uses.

Mission Bay

FIGURE VI.I.12
ALTERNATIVE A OPEN SPACE

SOURCE: Environmental Science Associates, Inc.

TABLE VI.I.3: PROJECT AREA SHADOW CONDITIONS, MAXIMUM BUILDING HEIGHTS AND 40-FOOT BUILDING HEIGHTS, ALTERNATIVE A, BUILD-OUT/2020

			Shadow Coverage (Percent)/a/											
			Spring Equinox (PST)/d/			Summer Solstice (PDT)/e/			Fall Equinox (PDT)/e/			Winter Solstice (PST)/d/		
Open Space/b/	Approximate Area (Acres)	Building Height/c/	10 am	Noon	3 pm	10 am	Noon	3 pm	10 am	Noon	3 pm	10 am	Noon	3 pm
China Basin Park (OS-1)	16.5	Maximum	0	0	10	0	0	0	0	0	10	0	0	40
		40 Feet	0	0	0	0	0	0	0	0	0	0	0	10
North of Channel (OS-6, OS-7)	4.0	Maximum	0	0	30	10	0	20	0	0	10	0	0	30
		40 Feet	0	0	10	0	0	0	0	0	10	0	0	10
South of Channel (OS-2, OS-3, OS-8)	12.9	Maximum	50	20	0	30	20	0	50	30	10	70	50	30
		40 Feet	20	10	0	10	10	0	20	10	0	40	20	10
North-South Corridor (OS-4)	2.5	Maximum	0	0	80	0	0	40	20	0	50	10	10	100
		40 Feet	0	0	40	0	0	20	0	0	30	0	10	70
Northwest-Southeast Corridor (OS-9)	3.4	Maximum	10	30	80	30	0	30	30	20	80	50	80	100
		40 Feet	10	20	40	10	0	20	10	10	40	30	40	80
16th Street Park (OS-10)	0.4	Maximum	0	0	0	0	0	0	0	0	0	40	10	60
		40 Feet	0	0	0	0	0	0	0	0	0	20	0	20
Central Square (OS-5)	2.0	Maximum	10	0	20	0	0	0	20	0	10	40	20	70
		40 Feet	0	0	0	0	0	0	0	0	0	10	10	30
Michigan Street Corridors (OS-11)	1.4	Maximum	40	70	80	20	30	60	30	60	80	60	70	100
		40 Feet	30	60	80	20	20	60	30	60	70	60	70	100

/a/ Rounded to nearest 10%. Shadow coverage of less than 5%, therefore, is shown as 0%.
/b/ Designations in parentheses are open space units defined in VI.D. Community Services and Infrastructure, Recreation and Parks, and Figure VI.I.12, p. VI.I.58.
/c/ See Appendix A. Table XIV.A.1, p. XIV.A.1, and Figure XIV.A.2, p. XIV.A.5, for height limit characterizations for Alternative A. The 40-foot height limit column summarizes shadow effects relative to Sunlight Ordinance criteria.
/d/ Spring Equinox (about March 21) and Winter Solstice (about December 21) are Pacific Standard Time (PST).
/e/ Fall Equinox (about September 21) and Summer Solstice (about June 21) are Pacific Daylight Time (PDT).

SOURCE: Environmental Science Associates, Inc.

shadow coverage is rounded to the nearest 10%; coverage less than 5% is given as "0" in the table. The text may thus refer to some minimal shadow effects that are noted as 0 in the corresponding table entry.

China Basin Park. China Basin Park (OS-1) would be a 16.5-acre area in the northeast corner of the Project Area. About eight acres would be used for active sports, possibly including a recreation building; the remaining area would be available for passive recreation. Buildings which would shade this area are the community facilities building (up to 70-foot maximum height) to the south, and the 110-foot hotel across Third Street to the west. The community facilities building would shade the southernmost portions of the open space in the morning hours, leaving more than 95% of the open space in sun at 10 a.m. (early morning shadows would be less). The hotel would begin to shade China Basin Park after noon, especially in winter. Afternoon shadows from both the hotel and community facilities would shade the western portion of the open space. At 3 p.m. between the spring and fall equinoxes, the majority of the open space would be still in sun; shading would increase during fall and winter, with almost half of the open space being shaded at 3 p.m. during the winter solstice. Shadows would increase after 3 p.m.

North of Channel. North of Channel open space (OS-6 and OS-7), about four acres in area, would include three acres for passive recreation and one acre near the freeway for active sports. Because the area would be separated from buildings to the south by the channel and open space south of the channel, the North of Channel open space would not be shaded by those buildings at any time. However, new shadow affecting this open space would come from 110-foot HDR buildings to the east and west. The open space would be almost completely in sun throughout the morning, and would be slightly shaded by the adjacent residential buildings at 3 p.m. Shadows would increase after 3 p.m.

South of Channel. South of Channel open space (OS-2, OS-3, and OS-8) includes about 12.9 acres west of Third Street, extending south to the extension of Tiernan Street. About four acres would be used for active sports, possibly including recreation buildings, while the remainder would be used for passive recreation. The area would be bounded by 70- to 90-foot MDR and MHDR buildings and the 110-foot hotel to the south, and the CalTrain commute station to the west. Buildings to the south would shade over half of the open space at 10 a.m., except during the summer. Early morning shadows would be greater. Shadows would shorten as noon approached. During the afternoon, the bearing of the sun would be generally in line with the southwest-northeast orientation of the open space, resulting in lesser, or no, shade compared to the morning.

North-South Corridor. The North-South Corridor (OS-4) would be a 2.5-acre corridor west of North Iowa Street with a walking and bike path. MDR and MHDR buildings with maximum heights of 70 to 90 feet would bound the area on the east and west. The eastern portion of the North-South Corridor would be shaded in the morning by the MDR buildings to the east. Each morning shadows would decrease until, at 10 a.m., the shadow would touch the eastern edge of the open space in fall and winter, but not in spring and summer. Noon shadows would be confined to a small area adjacent to the MHDR buildings to the west. Shadows from the residential buildings would lengthen steadily during the afternoon, shading a large portion of the corridor in the afternoon (up to 100% at 3 p.m. in winter).

Northwest-Southeast Corridor. The Northwest-Southeast Corridor (OS-9) would be a 3.4-acre corridor providing passive recreation and a paved walking and bike path. The area is bounded by MDR and MHDR buildings with 70-foot to 90-foot maximum heights. The corridor would be partially shaded at 10 a.m. (shadows would be greater before 10 a.m.). Shadows at 10 a.m. would be the most extensive during winter (about 50% shade). By noon, shadows from the residential buildings to the south would extend further into the corridor, shading a large portion by 3 p.m. Shadows would continue increasing after 3 p.m. (except in winter, when shading already covers 100% of the corridor at 3 p.m.).

16th Street Park. The 16th Street Park (OS-10) would be about one-half acre on the north side of 16th Street, west of Third Street, and would continue the open space path from the Northwest-Southeast Corridor. The park would be partially shaded by retail buildings (50-foot maximum height) on the south side of 16th Street. Shadows would extend across 16th Street throughout the day during winter, shading a small portion of the site at noon, and a larger portion in the morning and afternoon; shadows would not extend across 16th Street between 10 a.m. and 3 p.m. during other times of the year.

Central Square. Central Square (OS-5) would be a two-acre square in the center of the Project Area. This area would provide a neighborhood park for passive recreation. The square would be surrounded by MDR (70-foot maximum height) buildings, separated from the open space by streets. During winter, shadows from the residential buildings to the south would extend into the square, shading less than half of the square during the late morning and noontime hours, and most of the square in the afternoon. During spring and fall, about one-fifth of the square would be shaded. Summer shadows would not extend into the square between 10 a.m. and 3 p.m. Before 10 a.m. and after 3 p.m., shadows would be greater.

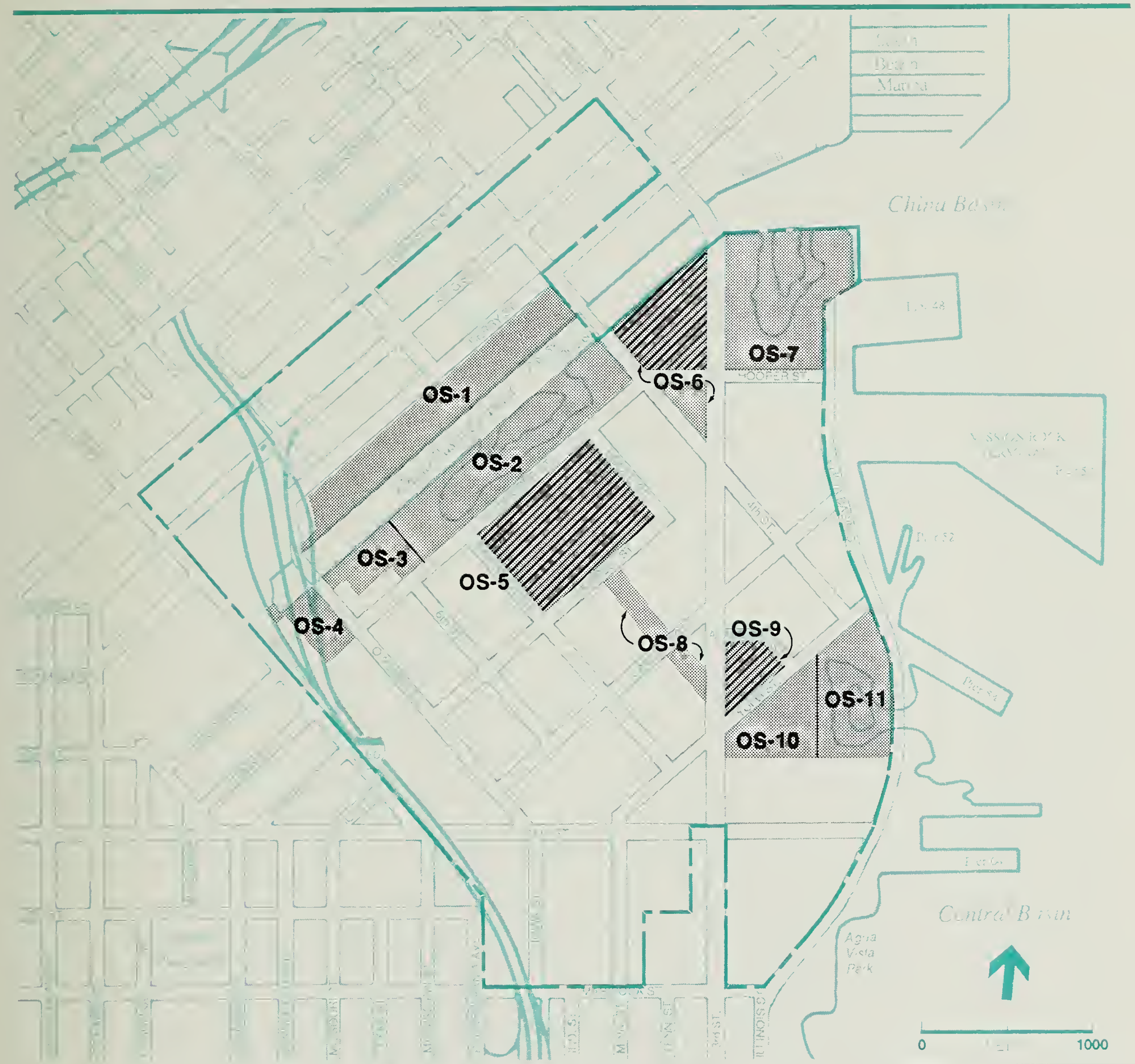
Michigan Street Corridors. The Michigan Street Corridors (OS-11) would be a series of narrow open spaces totaling 1.6 acres. The main corridor, aligned from the northwest to southeast, has two smaller corridors branching off to the west, and would widen to a small open space area at its southeast end. The corridors would be used for passive recreation and would contain a paved walking and biking path. These areas would be shaded by LDR and MDR buildings to the south, with 50-foot and 70-foot height limits, respectively. The majority of the open space in the east-west corridors would be in shade throughout the day. The open space in the northwest-southeast open space and the small area at the southeast end of the corridor would be partially shaded in the morning, with shadows increasing in the afternoon.

Shadow Conditions for 40-foot Buildings. Because the assumed heights of all buildings for Alternative A would exceed 40 feet, shadows resulting from 40-foot buildings would be less extensive. The differences would be greatest for shadows from taller buildings (e.g., the 110-foot hotel and HDR buildings and 90-foot MHDR buildings); differences in shadows from 50-foot LDR and retail buildings would be much less. Table VI.I.3, p. VI.I.59, estimates shadow coverage resulting from 40-foot buildings at 10 a.m., noon, and 3 p.m., on the spring and fall equinoxes and the summer and winter solstices.

Alternative B

Figure VI.I.13, p. VI.I.63, illustrates Alternative B open space and shows the open space units, and Table VI.I.4, p. VI.I.64, summarizes shadow coverage for Alternative B and shows percent of each unit or combination of units of open space covered by building shadow, rounded to the nearest 10%.

China Basin Park. China Basin Park (OS-6, OS-7) would be an area of about 20.9 acres in the northeast corner of the Project Area. This would include two irregularly shaped open space areas totaling 7.3 acres which would provide shoreline access and active and passive recreational uses, and a 13.6-acre wetlands. Buildings which would shade the area include medium density residential units (70-foot maximum height) to the southeast and the 50-foot low density residential units west of Third Street. The medium density residential buildings would shade the southernmost portion (10% or less) of the wetlands between


South Beach Marina
China Basin
OS-1
OS-2
OS-3
OS-4
OS-5
OS-6
OS-7
OS-8
OS-9
OS-10
OS-11
HOOPER ST.
4th ST.
Pier 48
Pier 50
Pier 52
Pier 54
Pier 64
Central Basin
Agua Vista Park
0
1000

— — — MISSION BAY BOUNDARY

▨ ACTIVE SPORTS AREA (non-hatched open space areas are passive open space)

OPEN SPACE PROVIDED BY 2000

OS-1	11.0 ACRES
OS-2	13.2 ACRES
OS-3	3.2 ACRES
OS-4	2.1 ACRES

OPEN SPACE PROVIDED AFTER 2000 AND BY 2020

OS-5	13.2 ACRES
OS-6	7.3 ACRES
OS-7	13.6 ACRES
OS-8	2.4 ACRES
OS-9	2.8 ACRES
OS-10	6.3 ACRES
OS-11	7.0 ACRES

NOTE: This figure does not show additional open space that would be included with housing, office and S/LI/RD uses.

FIGURE VI.I.13
ALTERNATIVE B OPEN SPACE

SOURCE: Environmental Science Associates, Inc.

TABLE VI.I.4: PROJECT AREA SHADOW CONDITIONS, MAXIMUM BUILDING HEIGHTS AND 40-FOOT BUILDING HEIGHTS, ALTERNATIVE B, BUILD-OUT/2020

Open Space/b/	Approximate Area (Acres)	Building Height/c/	Shadow Coverage (Percent)/a/											
			Spring Equinox (PST)/d/			Summer Solstice (PDT)/e/			Fall Equinox (PDT)/e/			Winter Solstice (PST)/d/		
			10 am	Noon	3 pm	10 am	Noon	3 pm	10 am	Noon	3 pm	10 am	Noon	3 pm
China Basin Park (OS-1)	16.5	Maximum	0	0	10	0	0	0	0	0	10	0	0	40
		40 Feet	0	0	0	0	0	0	0	0	0	0	0	10
North of Channel (OS-6, OS-7)	4.0	Maximum	0	0	30	10	0	20	0	0	10	0	0	30
		40 Feet	0	0	10	0	0	0	0	0	10	0	0	10
South of Channel (OS-2, OS-3, OS-8)	12.9	Maximum	50	20	0	30	20	0	50	30	10	70	50	30
		40 Feet	20	10	0	10	10	0	20	10	0	40	20	10
Central Square (OS-5)	2.0	Maximum	10	0	20	0	0	0	20	0	10	40	20	70
		40 Feet	0	0	0	0	0	0	0	0	0	0	0	10
Central Corridor (OS-8)	2.4	Maximum	10	30	60	30	0	30	20	10	50	30	50	100
		40 Feet	0	20	40	20	0	10	10	10	30	30	40	100
Bayshore Park (OS-9, OS-10, OS-11)	16.1	Maximum	10	10	10	0	10	0	10	10	10	20	20	30
		40 Feet	0	0	0	0	0	0	10	10	10	10	10	20

/a/ Rounded to nearest 10%. Shadow coverage of less than 5%, therefore, is shown as 0%.

/b/ Designations in parentheses are open space units defined in VI.D. Community Services and Infrastructure, Recreation and Parks, and Figure VI.I.13, p. VI.I.63.

/c/ See Appendix A, Table XIV.A.1, p. XIV.A.1, and Figure XIV.A.4, p. XIV.A.7, for height limit characterization for Alternative B. The 40-foot height limit column summarizes shadow effects relative to Sunlight Ordinance criteria.

/d/ Spring Equinox (about March 21) and Winter Solstice (about December 21) are Pacific Standard Time (PST).

/e/ Fall Equinox (about September 21) and Summer Solstice (about June 21) are Pacific Daylight Time (PDT).

SOURCE: Environmental Science Associates, Inc.

10 a.m. and 3 p.m. during winter; these buildings would not shade any of China Basin Park between 10 a.m. and 3 p.m. during other times of the year. Shadows from the low density residential buildings to the west would extend across Third Street into China Basin Park at 3 p.m. in winters. Shadow coverage would be greater before 10 a.m. and after 3 p.m.

North of Channel. The North of Channel open space (OS-1) would be an 11-acre area consisting of a 10.7-acre shoreline park and a 0.3-acre open space area continuing pedestrian access under the freeway. Because the area would be separated from buildings to the south by China Basin Channel and additional open space and wetlands south of the channel together with the lack of adjacent buildings to the east or west, the North of Channel open space would be shaded only to a limited extent by project-related buildings. However, the westernmost portion of the open space would be shaded by the existing freeway structure.

South of Channel. The South of Channel open space (OS-2, OS-3, and OS-4) would total about 18.5 acres and would include about 5.3 acres for passive recreation and pedestrian access and a 13.2-acre wetlands. The open space would be adjacent to two retail areas (50-foot maximum height) to the south and the CalTrain commute station (50-foot maximum height) to the west. Additional retail, open space (OS-5), and low density residential (50-foot maximum height) uses would be across Hooper Street to the south. The retail uses would shade a small portion of the open space (less than 5%) between 10 a.m. and 3 p.m. throughout the year. The CalTrain station would shade a small part of the westernmost portion of the open space during the afternoon. Shadows from the low density residential buildings separated from the open space by Hooper Street would shade the southernmost portion of the open space at 10 a.m. only in winter. The existing freeway structure would shade the westernmost portion of the open space. Shadow coverage before 10 a.m. and after 3 p.m. would be greater.

Central Square. Central Square (OS-5) would be a 13.2-acre square near the center of the Project Area. Throughout the year, 10 a.m. shadows from the MDR buildings (70-foot maximum height) to the south would extend across Hubbard Street to shade a strip of the square (less than 5%). During winter, shadows from the LDR (50-foot maximum height) and MDR buildings would also extend across Hubbell Street at 10 a.m., shading the southernmost portion of the open space. At 3 p.m. during the winter, shadows from the LDR buildings to the west would extend across the street, shading the westernmost portion. During summer, no Project Area buildings would shade the open space between 10 a.m. and 3 p.m. Shadow coverage would be greater before 10 a.m. and after 3 p.m.

Central Corridor. The Central Corridor (OS-8), a 2.4-acre corridor located south of Central Square, would provide a passive open space area, including a paved walking and biking path. Bounded by LDR (50-foot maximum height), MDR (70-foot maximum height), and retail (50-foot maximum height) uses on the east and west, portions of the open space would be shaded at every time of day throughout the year, ranging from less than 5% shade at noon during the summer to 100% shade at 3 p.m. during the winter.

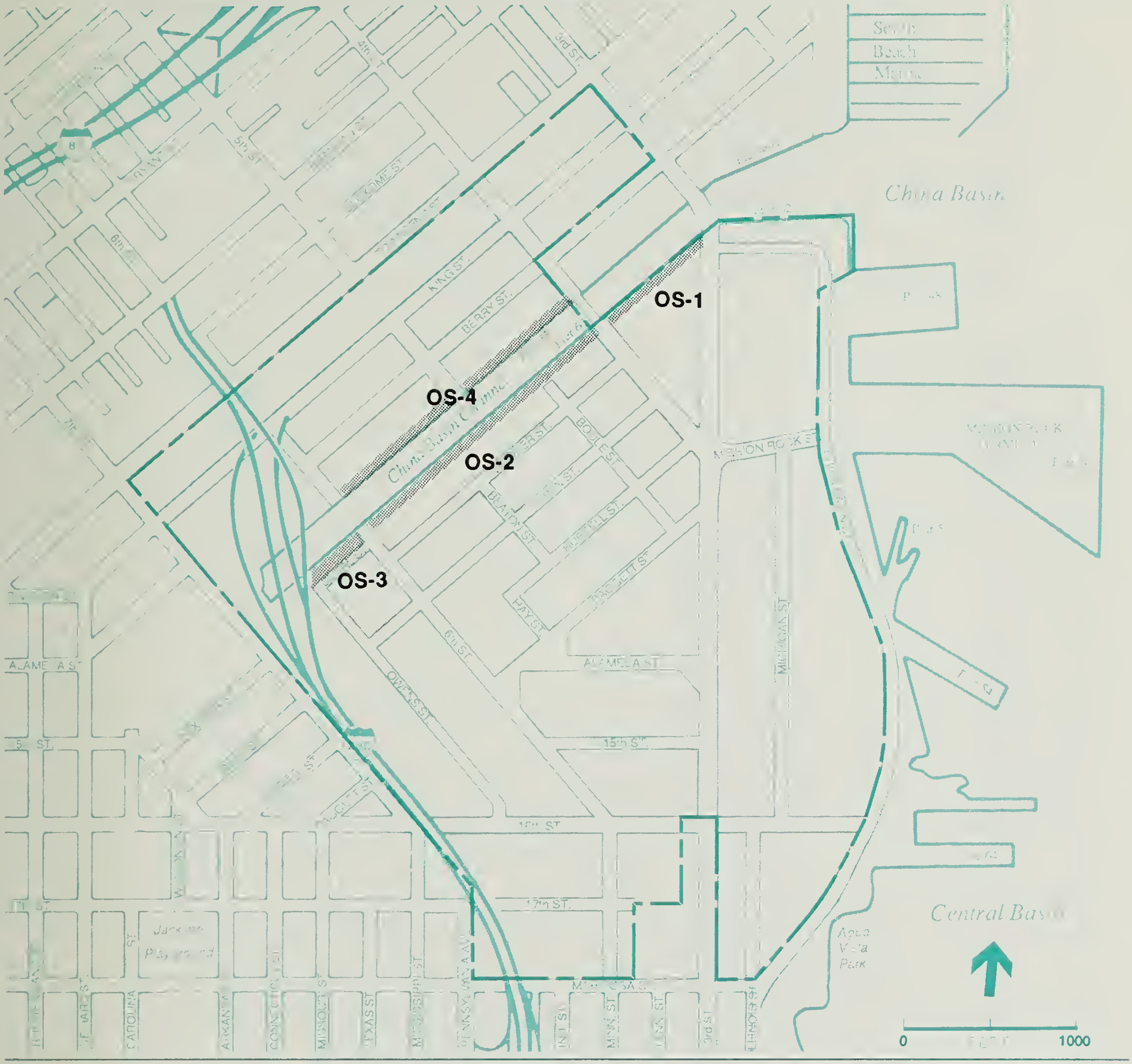
Bayshore Park. Bayshore Park (OS-9, OS-10, and OS-11), about 16.1 acres located in the southeast portion of the Project Area, would consist of a 2.8-acre active sports area, a 6.3-acre area for passive recreation, and a 7.0-acre wetlands. Bayshore Park would be adjacent to MDR buildings (70-foot maximum height) to the south, and is separated from MDR and retail (50-foot maximum height) buildings to the west by Third Street. The southernmost portion of the open space would be shaded by the adjacent residential buildings during all times of the day, throughout the year. On winter afternoons, shadows from the buildings west of Third Street would extend into the open space. Shading of the open space between 10 a.m. and 3 p.m. would range from less than 5% shade in summer to 30% shade in winter.

Shadow Conditions for 40-foot Buildings. Because the assumed height of all building for Alternative B would exceed 40 feet, shadows resulting from 40-foot buildings would be less extensive. The major differences would be shadows from the 70-foot MDR buildings on Bayshore Park, which would be reduced with 40-foot buildings. Table VI.I.4, p. VI.I.64, presents estimates of shadow coverage resulting from 40-foot buildings.

Alternative N

Figure VI.I.14, illustrates Alternative N open space and shows open space units, and Table VI.I.5, p. VI.I.68, summarizes shadow coverage for Alternative N and shows percent of each unit or combination of units of open space covered by building shadow, rounded to the nearest 10%.

North of Channel. North of Channel open space (OS-4) would consist of two open space strips for passive uses, totaling 1.8 acres in area. The open space would be adjacent to


South Beach Marina
China Basin
OS-1
OS-2
OS-3
OS-4
China Basin Channel
3rd ST.
4th ST.
5th ST.
6th ST.
7th ST.
8th ST.
BRYANT ST.
BRANNAN ST.
TOWNSEND ST.
KING ST.
BERRY ST.
BOULE ST.
BEALE ST.
OWENS ST.
MISSION ROCK ST.
MICHIGAN ST.
ALAMEDA ST.
15th ST.
16th ST.
17th ST.
MARIPOSA ST.
Jackson Playground
ARKANSAS
CONNECTICUT ST.
MISSOURI ST.
TEXAS ST.
MISSISSIPPI ST.
PENNSYLVANIA AVE.
INDIANA ST.
MINNESOTA ST.
TENNESSEE ST.
3rd ST.
ILLINOIS ST.
CAROLINA
Agua Vista Park
Central Basin
0
1000

MISSION BAY BOUNDARY

OPEN SPACE PROVIDED BY 2000	
OS-1	0.8 ACRE
OS-2	2.0 ACRES
OS-3	0.6 ACRE

OPEN SPACE PROVIDED AFTER 2000 AND BY 2020	
OS-4	1.8 ACRES

Mission Bay

FIGURE VI.I.14
ALTERNATIVE N OPEN SPACE

SOURCE: Environmental Science Associates, Inc.

TABLE VI.I.5: PROJECT AREA SHADOW CONDITIONS, MAXIMUM BUILDING HEIGHTS AND 40-FOOT BUILDING HEIGHTS, ALTERNATIVE N, BUILD-OUT/2020

			Shadow Coverage (Percent)/a/											
			Spring Equinox (PST)/d/			Summer Solstice (PDT)/e/			Fall Equinox (PDT)/e/			Winter Solstice (PST)/d/		
Open Space/b/	Approximate Area (Acres)	Building Height/c/	10 am	Noon	3 pm	10 am	Noon	3 pm	10 am	Noon	3 pm	10 am	Noon	3 pm
North of Channel (OS-4)	1.8	Maximum	0	0	30	0	0	20	0	0	0	0	0	0
		40 Feet	0	0	30	0	0	20	0	0	0	0	0	0
South of Channel (OS-1, OS-2, OS-3)	3.4	Maximum	80	50	0	70	40	0	80	40	0	90	80	20
		40 Feet	50	30	0	50	20	0	80	30	0	90	80	20

/a/ Rounded to nearest 10%. Shadow coverage of less than 5%, therefore, is shown as 0%.

/b/ Designations in parentheses are open space units defined in VI.D. Community Services and Infrastructure, Recreation and Parks, and Figure VI.I.14, p. VI.I.67.

/c/ See Appendix A, Table XIV.A.1, p. XIV.A.1, and Figure XIV.A.6, p. XIV.A.9, for height limits for Alternative N. The 40-foot height limit column summarizes shadow effects relative to Sunlight Ordinance criteria.

/d/ Spring Equinox (about March 21) and Winter Solstice (about December 21) are Pacific Standard Time (PST).

/e/ Fall Equinox (about September 21) and Summer Solstice (about June 21) are Pacific Daylight Time (PDT).

SOURCE: Environmental Science Associates, Inc.

M-2 Industrial uses (assumed to be up to 40 feet high) to the north, and would be separated from buildings to the south by China Basin Channel and an additional open space strip south of the channel./14/ The open space would be shaded only during late afternoon, when M-2 buildings to the west would shade adjacent areas. Up to a third of the adjacent open space would be shaded at 3 p.m. during spring and summer. The North of Channel open space would not be shaded by buildings to the south at any time.

South of Channel. South of Channel open space (OS-1, OS-2, and OS-3) would consist of three open space strips totaling 3.4 acres. These areas would be bounded by M-2 Industrial uses (50-foot height limit under existing zoning) to the south. The open space would be shaded by the adjacent buildings throughout the year. Shadows would be greatest in the morning when the bearing of the sun generally would be perpendicular to the open space, shading most of the open space in winter; shadows would be less during the afternoon when the bearing of the sun would be generally in line with the open space./13/

Shadow Conditions for 40-foot Buildings. The assumed heights of M-2 buildings north of China Basin Channel are 40 feet; therefore, shadows on Project Area open space from buildings under the 40-foot criteria would be identical to the maximum impacts of those assumed under Alternative N. (The 105-foot office buildings in the Third-Townsend block in Alternative N would not shade Mission Bay open space. Thus, the 40-foot criteria would not affect that conclusion.) Maximum building heights immediately south of China Basin Channel under existing zoning are 50 feet; shadows on the South of Channel Open Space would be reduced with 40-foot buildings. Table VI.I.5, p. VI.I.68, estimates shadow coverage resulting from 40-foot buildings at 10 a.m., noon, and 3 p.m., on the spring and fall equinoxes and the summer and winter solstices.

WIND

Wind Conditions in San Francisco

U.S. Weather Bureau data show that westerly (i.e., from the west) to northwesterly winds are the most frequent and strongest winds during all seasons in San Francisco./15/ Of the 16 primary wind directions measured at the Weather Bureau station at the Civic Center (at a height of 132 feet), four directions comprise the greatest frequency of occurrence as well as the majority of strong wind occurrences. These are northwest, west-northwest,

west, and west-southwest, with occurrence rates of about 10%, 14%, 35%, and 2%, respectively, of the time between the hours of 6:00 a.m. to 8:00 p.m. throughout the year. The remaining 12 wind directions comprise the remaining 36% frequency of annual occurrence with lower wind speeds. Calm conditions occur about 2% of the time.

Average wind speeds are highest during summer and lowest during winter months. However, strongest peak winds occur in winter, when speeds of 47 mph have been recorded./16/ The highest average wind speeds are in the mid-afternoon, and the lowest are in the early morning.

Pedestrian Comfort and Wind Criteria

Wind conditions partly determine pedestrian comfort on sidewalks and in other public areas. In developed areas, buildings about 100 feet or more in height can redirect wind flows around buildings and divert winds downward to street level; each can result in increased wind speed and turbulence at street level.

As an example of criteria for a comfortable wind environment for people, Section 148 of the City Planning Code establishes for the C-3 Downtown Commercial districts an equivalent (includes the effects of turbulence) wind speed (as defined in the Code) of 7 and 11 mph as comfort criteria and 26 mph as a wind hazard criterion. Section 148 sets comfort levels of 7 mph equivalent wind speed for public seating areas and 11 mph equivalent wind speed for areas of substantial pedestrian use. New buildings and additions to buildings may not cause ground level winds that would exceed these levels more than 10% of the time year round between 7:00 a.m. and 6:00 p.m./17/ Section 148 would not apply to Mission Bay, which is not in a C-3 district.

Build-Out/2020

Wind Effects in Mission Bay

Prevailing winds in and near the downtown area, including Mission Bay, are from the northwest, west-northwest, west, and west-southwest. The extent and magnitude of wind effects of new buildings would depend on the actual design, height, bulk and placement of each specific structure in relationship to adjacent buildings, streets and open space areas. This evaluation is therefore general in nature; no wind-tunnel testing could be usefully performed.

Due to the relatively low- to mid-rise character of all Alternatives, little difference in wind conditions would be expected among Alternatives A and B and existing wind conditions. The absence of high-rise buildings, which might be expected to cause substantial increased winds at pedestrian levels, indicates that no such increase in winds should occur.

As discussed on p. VI.I.34, the Alternative N scenario anticipates M-2 buildings generally up to four stories high, with office buildings up to eight stories in the Third and Townsend block. Existing height limits in portions of the Project Area range from 80 to 200 feet, which could permit buildings from 8 to 20 stories; buildings of 100 feet or taller might be expected to increase ground-level wind speeds, depending upon the heights, configurations, and orientations of surrounding buildings and streets. (See V. The EIR Alternatives and Approval Process, pp. V.A.16–V.A.17, for a discussion of Alternative N land use assumptions.)

No winds that meet the hazard level, defined as an hourly average of 26 mph for more than any single hour of the year, could be expected from any of the Alternatives.

In general, ground-level winds would be expected to divide around and flow over the building masses and to follow open, linear features, such as streets and open spaces, that generally align with the wind direction. Thus, for each Alternative and each specific wind condition, streets and open spaces that line up with the wind would be expected to have winds higher than those streets at right angles to the wind.

To the extent that any linear open areas or streets can be kept short or can be interrupted by tall trees, or by buildings or other structures, wind flows along those streets or open areas would be slowed, and pedestrian level wind speeds reduced accordingly.

MITIGATION

ARCHITECTURAL RESOURCES

Measure	Alternative	Description
I.1	A,N	To maintain the architectural integrity of closed Fire Station 30, rehabilitate the building as a new fire station or other community service use. The rehabilitation plan would be developed under appropriate historic preservation standards.
URBAN DESIGN		
I.2	A,B	Adopt urban design guidelines for Mission Bay which would include requirements for variation in building height, bulk, tower separation, mid-block paths or courts, and facade materials to relate the architectural character of new buildings to that of existing older buildings fronting Townsend Street, and Seventh Street and to the closed Fire Station 30. This measure would also avoid, to the extent applicable or appropriate, "benching," or developing a row of buildings of similar height over one or more block fronts.
I.3	A,B,N	Adopt urban design guidelines for Mission Bay which would require adequate sidewalk widths and street lighting and landscaping.
I.4	A,B	Develop specific guidelines for landscaping, setbacks, parking location and screening where residential uses would adjoin S/LI/RD areas. These would maintain the visual quality of residential areas, and screen those uses from more intense S/LI/RD activities.
I.5	A,B	Formulate height guidelines, building setbacks and separation of towers to limit scale of office or S/LI/RD development between Owens Street and I-280. These

Measure	Alternative	Description
		would maintain some views of the Project Area and the Bay from I-280, and prevent visual impact of a continuous wall of eight-story buildings immediately east of the 30- to 40-foot-high freeway structure, (while continuing to provide land use and noise buffer transition between the freeway and residential uses).
I.6	N	Reduce the 200-foot height district in the center of the Project Area to 130 feet. That would be consistent with the adjoining existing 130-foot district, and would be generally consistent with the 110-foot maximum height limits proposed for Alternatives A and B. That measure would limit new view blockage by buildings up to 200 feet in Alternative N. While the Alternative N scenario assumes one-to four-story M-2 industrial development, the existing 200-foot district would permit potential view blockage by high-rise structures in the center of the Project Area.
SHADOWS		
I.7	A,B	Include design considerations to reduce the area of open space shadowed such as: - articulation of the building face, resulting in setbacks of portions of the building walls; - setbacks of building levels above 40 feet; - building separation along otherwise continuous frontages; - tower separation and setbacks; - mansard or gable roof treatments that reduce effective rooftops heights at the building frontage, and - reduce the total height of buildings that are adjacent to or near by, and also south, east or west of, public open spaces.

Measure	Alternative	Description
		(Shadowing of public open spaces, as discussed on pp. VI.I.51–VI.I.69, effectively represents maximum shadow from building masses assuming maximum height at the property line along a continuous frontage during general daytime periods of highest use.)
I.8	A,B	If major Mission Bay open space were to be acquired by or were under the jurisdiction of the Recreation and Parks Commission, Proposition K criteria could limit specific Project Area buildings to 40 feet or less. Shadow effects of such buildings are described on pp. VI.I.62, VI.I.66, and VI.I.69 and Tables VI.I.2, VI.I.3, and VI.I.4, pp. VI.I.19, VI.I.59, and VI.I.64. Ownership of or jurisdiction over open space proposed in Mission Bay, and the applicability of Proposition K, has not been determined. If open space were not under Recreation and Park jurisdiction, Proposition K criteria would still provide a general basis for evaluation of shadow effects of specific Mission Bay development on major open space.
WIND		
I.9	A,B	Include design factors to reduce wind speeds and turbulence such as: – building setbacks along street frontages above the second or third floor, and setbacks on all sides for buildings that are more than two stories taller than adjacent structures; and – articulation of the building facade and balconies or bay windows; and – trellises, walls, large mature trees, and other elements to break up wind flows though mid-block lanes and courtyards. The difference between the existing wind environment and the wind environment under any of the Alternatives would

Measure	Alternative	Description
		be expected to be small. Practical design consideration, landscaping and amenities would tend to reduce wind speeds and turbulence along street and in public and private open space areas. Providing windbreaks within open spaces and large street trees along sidewalks and street medians wherever possible would tend to reduce street-level wind speeds. Windbreaks would provide protection for passive uses of parks, and large street trees would provide wind protection along sidewalks and at building entrances.
I.10	A,B,N	Require a qualified wind consultant to review specific designs for buildings 100 feet or more in height for potential wind effects. The review would evaluate the need for windbreak features or further detailed wind-tunnel studies of the proposed structures.

NOTES

SETTING

• /1/ In this Architectural Inventory, approximately 10% of the City's entire stock of buildings were rated for architectural merit. The Department of City Planning Architectural Inventory assigned two ratings to each building: (1) an overall rating for architectural appearance and (2) a summary rating that took into consideration the building's architectural rating as well as its importance to the streetscape. The numerical ratings were a low of "0" to a high of "5". In general, buildings with a summary rating of "3" or higher from the DCP survey were considered to represent approximately the best 2% of the architecture in the City.

/2/ This total does not include six rated buildings demolished since the survey was completed.

/3/ Foundation for San Francisco's Architectural Heritage, "South of Market Street - A Brief Guide to its Architecture: Parts I and II, Heritage Newsletter, Vol. XIII, Nos. 2 and 3, 1986. Unlike Heritage surveys of Downtown, the three South of Market surveys do not specifically publish ratings of buildings on a scale of "A" (highest rating) to "D" (minor or of no importance). The buildings listed in the newsletter articles are mapped and described as "historically and architecturally significant buildings."

/4/ John Snyder, "Historic Architectural Survey Report for 4-SF-, I-280 Transfer Concept," Caltrans, August 1983.

/5/ Jonathan Malone, Secretary, San Francisco Landmarks Preservation Advisory Board, telephone conversation, February 17, 1988.

/6/ The photograph in Figure VI.I.2 taken from Potrero Hill shows the entire Mission Bay Project Area. To provide an unobstructed view, the photograph was taken from the roof of the former Patrick Henry School at 639 Vermont Street. The closest approximation of this view at street level is at the corner of Kansas and 19th Streets. Although the viewpoint location is not publicly accessible, it does provide an overall view of the Project Area, similar to those partially available from public streets on Potrero Hill, or those from existing residences or other buildings in north Potrero Hill. The view would vary depending upon the elevation of the street or building; at lower elevations, views of the Project Area are more limited. Higher elevations on Potrero Hill (up to about 300 feet near 22nd and Wisconsin) are further south, and would also not encompass views of the entire Project Area. The Vermont Street photo location is at about the 220-foot elevation.

/7/ San Francisco Department of City Planning, Urban Design Element, adopted by City Planning Commission, Resolution 6745, August 26, 1971.

IMPACT

/8/ San Francisco Department of City Planning, South of Market Plan, Proposal for Citizen Review, June 1985.

/9/ San Francisco City Planning Code Section 260, allows for exit stairways, elevators and mechanical penthouses, etc. to exceed the height limit by 16 feet.

/10/ San Francisco City Planning Code Section 270 regulates height, bulk and setbacks.

/11/ Bulk controls apply above specific heights (50 to 80 feet). Up to those heights there is no limit to the width of a building. Above those heights, bulk district designation limits building plan dimensions.

/12/ San Francisco City Planning Code, Zoning Map Sheets 1, 1H, 8 and 8H.

/13/ The shadow analysis is based on generalized shadow diagrams prepared by Environmental Science Associates, Inc.

/14/ As discussed on p. VI.I.35, existing height limits in the Project Area range from 40 to 200 feet, with 130 to 200-foot districts south of Hooper Street. One-hundred-thirty-foot to 200-foot buildings in those height districts would not change the shadow effects on open space described for Alternative N.

/15/ The U.S. Weather Bureau data used in this analysis were originally gathered at the weather station atop the old Federal Building at 50 United Nations Plaza at the Civic Center during the years 1945-50. Data were taken hourly, annually for 16 wind directions. The data base, comprised of 32,795 hourly observations, is of sufficient length to provide a reliable estimate of future climatic conditions in San Francisco.

/16/ E. Jan Null, "Climate of San Francisco," NOAA Technical Memorandum, NWS WR-126, February 1978.

/17/ Section 148 of the City Planning Code specifies the hours of 7:00 a.m. to 6:00 p.m. The available weather data that include the interval cover the hours of 6:00 a.m. to 8:00 p.m. Thus, observation from two additional evening hours and one additional morning hour are included in these data. Because, in general, winds are stronger in the afternoon and evening than in the morning, this approximation is conservative - it is likely to overestimate existing and projected wind speeds.

J. CULTURAL RESOURCES

SETTING

PREHISTORY

Prehistoric Period, 2500 B.C. to 1500 A.D.

The prehistoric occupation and use of the San Francisco Bay Area are not well known. The majority of prehistoric archaeological sites that are believed to have existed in San Francisco are either totally destroyed or inaccessible due to surface cover. As San Francisco developed quickly during the Gold Rush, it is likely that numerous archaeological sites were destroyed before systematic archaeological recording and evaluation procedures were practiced.

However, on the basis of archaeological data from San Francisco sites that have survived, and information from sites located in other Bay Area counties, and ethnographic sources, it is possible to present at least a partial picture of prehistoric habitation in the region. The prehistoric human way of life in the San Francisco area involved a hunting and gathering network of subsistence systems. Seasonally, parties went out from villages to temporary camps within their territory to exploit the various available resources through hunting and gathering of mussels and shellfish, salmon, seals and land mammals, and intensive use of plant foods, including the common use of acorns.

Protohistoric Period, 1500s to 1770s

The California Indians who occupied the San Francisco Peninsula at the time of European contact are known as the Costanoan. The term Costanoan is derived from the Spanish word "Costanos," meaning coast people. No native name for the Costanoan people as a whole is known to have existed in prehistoric times. Scholars believe the Costanoans were neither a single ethnic group nor a political entity./1/ Native Americans living in the Bay Area today prefer the term "Ohlone," meaning the "Abalone people" when referring to their ancestral identity. The term Costanoan also designates a language family consisting of eight languages.

HISTORY

The Spanish/Mexican and Gold Rush Eras, 1770s to 1860s

Before the Gold Rush, nearly all of the Project Area was encompassed by Mission Bay, which derived its name from the Spanish mission located at Laguna de Los Dolores. Established in 1776, Mission San Francisco de Asis (or Dolores) lay slightly more than a mile west of the bay, at what is now the intersection of 16th and Dolores Streets. Mission Bay was a half-moon-shaped indentation in the shoreline of San Francisco and perhaps the most topographically pronounced cove, bay or creek on the peninsula (see Figure VI.N.1, p. VI.N.6.). At high tide the waters of the bay were bounded approximately by Eighth Street to the west, Brannan Street to the north and 16th Street to the south./2/ With a depth of one foot or less at mean low tide and rising to a maximum of five to six feet at high tide, Mission Bay measured approximately 260 acres./3/

Mission Creek entered Mission Bay almost at the center of its shoreline and was the main drainage channel for the east-facing slope of Twin Peaks and adjacent areas. Along its course, where spring tides were liable to flood, the creek was lined with marshes./2,4/ The marshes surrounding bay and creek covered approximately 330 acres./5/

Mission Bay waters were shallow but navigable. So too was Mission Creek and "navigation by small boat or Indian tule canoe of about a mile up Mission Creek would bring a traveler within a quarter of a mile of the Mission."/6/ John Young asserted that "in the early 19th century, several boats as large as 'two 30-ton schooners' built at Fort Ross carried hides and tallow and engaged in trading activities between the missions around the San Francisco Bay, including the Mission Dolores landing on Mission Creek."/7/ Mission Bay was not used extensively as a harbor or place of anchorage in the pre-Gold Rush era; better harbor facilities and a larger population and settlement were present at nearby Yerba Buena Cove to the north. Before the Gold Rush, the Project Area and what is now the south of Market region apparently were uninhabited.

During and after the Gold Rush, Mission Bay waters undoubtedly were used by San Francisco Bay scow schooners and similar craft. The use of Mission Creek was indicated by the fact that the State Legislature determined in 1854 that the creek was navigable, and when a franchise was issued for the Brannan Street road in 1855, the construction of a drawbridge (outside the Project Area) was required so as "not to obstruct the free navigation of the creek."/8/ What remains of Mission Creek is now known as China Basin Channel.

The Gold Rush did not immediately transform the Project Area. In the late 1840s and 1850s, San Francisco development concentrated at the Yerba Buena Cove waterfront north of Mission Bay, which was deeper and more accessible to ocean-going vessels. The most notable development within the Project Area was the establishment of shipbuilding facilities at Steamboat Point, located approximately at Fourth and King Streets. The feverish demands of the settlers and miners for vessels to take them to the trailheads on the Sacramento and San Joaquin River systems, as well as to the Humboldt Bay region, made shipbuilding one of San Francisco's first boom industries. The need to maintain and build vessels for the transportation of freight and passengers to the East Coast further stimulated this enterprise.

The Coast Survey Chart of 1853 (compiled in 1853 or earlier) shows three structures, probably associated with shipbuilding and maintenance, on the shores of Steamboat Point. Certainly, by the late 1850s, shipbuilding was a flourishing industry at that location. All that was required for a shipyard was proximity to water and a sliver of flat land big enough on which to set up the vessel, as it was materials and craftsmen that actually constituted the shipyard. By the late 1850s, shipbuilding was not the only activity at Steamboat Point. Saloons and dwellings also were located "at King and Steamboat Point" and "at the foot of Third Street."/9,10/ These facilities probably catered almost entirely to the shipyard workers, considering their somewhat remote location from the other parts of the City. By 1861, however, the shipbuilders were starting to move away from Steamboat Point. The completion of Long Bridge in 1868 across the mouth of Mission Bay, directly linking downtown San Francisco with the Potrero District and Hunters Point, encouraged the migration of the shipbuilding industry away from Steamboat Point, so that by the 1870s, Hunters Point was the City's major shipbuilding center.

During the early 1850s, a Chinese fishing village was established close to the northern periphery of the Project Area (just east of the intersection of Bryant and Second Streets). Sampans associated with this village would have been ideal for navigating Mission Bay, while the junks quite likely carried passengers and cargo from China.

Some bay fill may have occurred around Mission Creek in the late 1850s, and by the early 1860s, development had begun to occur in the Project Area that foreshadowed its evolution by the 1880s into one of San Francisco's prime industrial areas. At the same time that bay filling was beginning, transportation was improving. The growth of public transportation in the 1850s, horse-drawn omnibuses, aided this development. Routes linked South Park -- an elite residential neighborhood a few blocks north of the Project Area -- with Portsmouth Square, the Presidio and North Beach. San Franciscans used boats to get around the City as well, and one rowboat line carried passengers from the downtown waterfront to Mission Dolores by way of Mission Bay and Mission Creek./11/ Rowboats and horse-drawn omnibuses became a rarity by the 1860s with the founding of the first street railroads. Among those was the Omnibus Railroad, which opened in 1861. That railroad had a complicated route running between Mission Dolores and the end of Powell Street on the Bay. The route included Third Street in the Project Area. During the 1860s, the terminus of this branch of the Omnibus Railroad was near King and Third Streets./12,13,14/

The Origins and Evolution of a Pioneer Industrial Area, Mid-1860s to 1900

Prior to the mid-1860s, relatively little development had taken place in the Project Area and the southern waterfront of San Francisco. Only a limited amount of filling had occurred, along the fringes of the northern shores of Mission Bay. While the filling of Mission Bay was not complete even by the 1890s, by the late 19th century the Project Area, the southern waterfront and the South of Market area had become a major industrial and commercial area that mirrored the progress and industrial diversity of San Francisco's development during this period.

Long Bridge was built across Mission Bay in 1868 from the foot of Fourth Street near Steamboat Point to the present day intersection of Third and 16th Streets near Point San Quentin. Long Bridge both stimulated and reflected the accelerating development of the northern and southern fringes of Mission Bay. The mid-1860s saw the first appearance of early industrial establishments in the two blocks bounded by Second, Fourth, Townsend, and King Streets, a portion of which is in the Project Area, and also in one block near the southern boundary of the Project Area on Minnesota Street between Mariposa and 17th Streets. Two major industrial enterprises were the Citizens Gas Works, established in 1863-1864 at the junction of Townsend, King and Second Streets and the Pacific Oil and Lead Works, established in 1866 near the center of the block bounded by Second, Third, Townsend and King. By 1877, the portion of Mission Bay southwest from Steamboat Point to the mouth of Mission Creek had been filled. Two large triangular wharves were built on the east side of Long Bridge just south of the present-day channel; and new fill was added for wharves on the north side of the channel east of Fourth Street. The fill along Long Bridge was widened, and substantial areas of fill were added on the northern and eastern sides of Point San Quentin (see Figure VI.N.1, p. VI.N.6).

Two other pioneer industrial establishments from this era were the glass factories of the Pacific Glass Works and the San Francisco Glass Works. The Pacific Glass Works plant was located outside the Project Area on Minnesota Street, just north of its intersection with Mariposa Street. It was the first successful glass works on the Pacific Coast and its establishment was welcomed, since in the early 1860s San Francisco alone was importing between 125,000 and 150,000 bottles a year. This glass works lasted from 1863 until 1876 when it merged with its main competitor, the San Francisco Glass Works in the Project Area on the south side of Townsend Street, between Third and Fourth Streets. After an 1868 fire, the plant reopened at the same site. In 1870, however, the San Francisco Glass Works opened a new factory on King Street, between Fourth and Fifth Streets. In 1887, the plant moved to the northeast corner of Townsend and Seventh Streets, adjacent to the Project Area./15/

The history of industrial development of the Project Area in the late 19th century must stress the broad involvement of the Southern Pacific Railroad. The railroad was also the largest landholder in the Project Area for almost the entire post-Gold Rush era, and played the most important role in the filling of Mission Bay. In the 1870s, Southern Pacific constructed a railroad terminus in San Francisco. In addition to the main terminal building, other large structures were built: three large freight warehouses were erected on Townsend and King Streets between Fourth and Fifth Streets and on Kentucky Street (present-day Third Street) near Long Bridge./16/ Building of a railroad terminus in the Project Area also helped shape the pace and character of the area's economic development.

Information concerning the precise chronology and the location of fill is sparse. Figure VI.N.1, p. VI.N.6 shows the approximate locations and dates of fill. By 1884, substantial new areas of fill around the now-enclosed Mission Bay had been added, along with a long finger pier that extended southwest along the south side of the present-day channel, with a spur extending southeast into the center of Mission Bay. Fill was also added along the north side of the present-day channel westerly from Fourth Street. By

1892, additional fill had been placed around the margins of Mission Bay, leaving a totally enclosed body of water cut off from San Francisco Bay. During this period, two large areas of fill were placed east of Long Bridge. During the 1890s, Southern Pacific gradually developed its property in the Project Area and increased the number of spurs and sidings to accommodate growing freight traffic. By 1903, more than two-thirds of the Southern Pacific's holdings inside Long Bridge as well as an additional eight acres on the east side of the bridge were reclaimed land. By this time, the salt marshes along Mission Creek had disappeared because fill placed in Mission Bay reduced the tidal flow of sea water that nourished the marshes./17/ The remaining, now-stagnant open water in the center of the former Mission Bay was filled in with earthquake rubble following the 1906 earthquake. Between 1892 and 1913, the area east of Point San Quentin and Long Bridge (Third Street) was also filled to approximately its existing extent.

The major industries that developed in Mission Bay in the late 19th century were associated with California's booming lumber industry. Lumber was stored, shipped or made into finished products at many sites in the Project Area. California was one of the nation's most important lumber-producing states from the mid-19th century into the 20th century. While coastal lumbering port towns such as Eureka could export lumber directly to the East Coast and foreign markets, most lumber cut in northern California was shipped first to San Francisco. The bulk of it was, at least until the end of the 19th century, consumed in the San Francisco Bay Area for construction of homes, ships and railroads. Wood remained the primary source of energy in America until very late in the 19th century, when it was replaced by coal, oil and electric power. The lumber that was not absorbed by the Bay Area market was shipped by rail to southern California and the East Coast, and by ship to foreign countries.

The Project Area was ideally situated to capitalize on the lumber trade. It could receive ships engaged in the coastal lumber business, while railroads brought in lumber produced in California's inland counties. Shipping and railroad facilities made it an excellent place from which to transport milled lumber or finished wood products. Some companies preferred to convert their lumber into finished products at factories or workshops in the Project Area.

The first lumber entrepreneur to locate in Mission Bay was Charles Hooper at a plant on the south side of Townsend Street between Third and Fourth Streets in 1865; he moved in

1867 to the south side of China Basin Channel between Third and Fourth Streets. His yard soon was surrounded by other large lumberyards, such as the Pacific Pine Lumber Company, immediately south of his yard.

By the 1880s, almost all the businesses in this area were wood-related, and included the California Cigar Box factory; J.R. Fairweather's Sash, Door and Blind Company; George Windeler's Cooperage; and Andrew Frei's Furniture Company./18/ Hooper's own business on Channel Street between Third and Fourth Streets was still in existence in 1913 and probably continued for some years thereafter.

Other major lumber companies that were established in the Project Area by the late 1880s were the Truckee Lumber Company on Berry Street between Fourth and Fifth Streets; the Sierra Lumber Company at Fourth and Berry Streets; the Kennedy and Shaw Lumber Company on Fourth Street between Channel and Berry Streets. Andrew Frei's Furniture Manufactory, on the south side of King Street between Third and Fourth Streets, expanded by 1887 with a furniture warehouse on King Street towards Third Street.

The rapid development and diversification of California agriculture in the late 19th century created the need for plants to store large quantities of produce and to preserve or can meat, fruit and vegetables. The preservation of perishable foods was a major problem for California farmers, especially as they sought to exploit a growing national and world market. Transportation of produce, even with good rail connections, could take weeks and even months in the case of foreign export. The majority of California's rapidly expanding citrus crop was preserved by canning. The Pacific Can Company, a major plant outside the Project Area on the north side of Townsend Street between Sixth and Seventh Streets, was operational by 1887, or earlier. Two hundred men were employed and 250,000 cans of all shapes and sizes were turned out daily. The plant operated at least until 1902.

Several large plants in the Project Area produced, obtained or distributed ice for food preservation, often combined with refrigerating a particular line of produce. On the east side of Fourth Street between Berry and King Streets was the Union Ice Company. The company was in operation by 1882 and continued at the same location until 1907. The Brown Ice House and Meat Packing Plant was adjacent to the Union Ice Company on Fourth Street. It began business as the Mutual Ice Company in 1879 and by 1883 was the Mountain Ice Company. By 1891 this company was no longer in business./19/ There were several other smaller ice plants in the Project Area as well. Another major food enterprise was the National Vinegar Works on the south side of Berry Street between Fourth and Fifth Streets, in operation between 1884 and 1896./20/

The availability of space and excellent transportation for large and bulky goods resulted in the establishment by the 1880s of numerous warehouses in the Project Area. On the north side of Berry Street between Fifth and Sixth Street were the Studebaker Brothers, manufacturing carriages and wagons, and a large warehouse. On the north side of King Street between Third and Fourth Streets was the Arizona Warehouse. It operated from 1886 to at least 1898 but no later than 1919, when the site was covered by a Southern Pacific freight shed.

The nature of manufacturing in the Project Area in the late 19th century mirrored San Francisco as a whole in that it was characterized by great diversity and not dominated by one or a few industries. Although wood-product industries were the most important general category of manufacturing in the City, other enterprises included brick manufacturing, iron processing and manufacturing, and shipbuilding.

The center of the San Francisco shipbuilding industry had moved to the south of the City by the 1880s, but some shipbuilding activity continued in the Project Area. Patrick H. Tiernan, a shipbuilder who had moved away from Steamboat Point in the mid-1860s, relocated near the southern tip of the Project Area at the foot of 17th Street on the east side of present-day Third Street. That shipyard later was occupied by the Dickie Brothers who built large ocean-going vessels./21/

On the south side of Berry Street between Sixth and Seventh Streets were the shipyards of Boole and Beaton and of Alexander Hay. One block to the northeast, Hay had another large shipyard on the south side of Berry Street. In the late 1880s, they were the largest builders of steam schooners on the West Coast. Such vessels no longer were dependent on the vagaries of the wind and could transport much more cargo than the largest sailing schooners. Precise dates of these shipbuilders' operations are not known; they began operations in the early 1880s, but by the end of the decade both concerns had left the area. By 1891 Boole and Beaton had moved its shipbuilding operations to Oakland and Hay's yard was occupied by a Standard Oil Company storage tank and a lumberyard belonging to the Pacific Lumber Company./22/ By 1887, Standard Oil Company had erected six large storage tanks on Sixth Street between King and Berry Streets.

Two other oil companies were operating in the Project Area in the mid-1890's by that time. Next to Hay's shipyard on the south side of Berry Street between Sixth and Seventh Streets was the American Oil Company; the petroleum oil firm was still at that location in 1890, but by 1891, the space was occupied by the Pacific Brick Company./23/ The Arctic Oil Works, a whale-oil plant, was located from 1884 until 1902 in the vicinity of Illinois and 16th Streets.

Several wool processing and chemical plants also contributed to the industrial diversity of the area in the late 19th century. Calton Bell and Company was the most prominent of the wool operations, located from 1876 to 1905 on the north side of Townsend Street between Sixth and Seventh Streets north of the Project Area. Also located on the north side of this block, from 1867 to 1894, was the Golden City Chemical Works.

By 1887 numerous boarding houses, saloons and restaurants catered to the Project Area's workers. Representative of these was the Crystal Hotel established in 1887 on the northeast corner of Fourth and Berry Streets. The property evidently survived the 1906 earthquake as it was still in business in 1907./24/ The Cuckoo's Nest at the southeast corner of Fourth Street near the channel fed the numerous workers in the area.

There were many workers, however, who were not fortunate enough to lunch at the Cuckoo's Nest and were forced to eke out an existence by more painstaking means. Some time between 1869 and 1877, the City established a major dump on Berry Street between Fifth and Sixth Streets shortly after that location had been reclaimed from Mission Bay. By the 1870s, so many indigent men lived in shanties on the edges of the dump that it was called "Ragtown."/25/

The dump grew southwards from Channel Street between Sixth and Seventh Streets until it is said to have covered an area of 20 acres, most of which was owned by Southern Pacific. Foraging through the dump developed into an industry. As early as 1878 an "Old Italian" acquired "scavenger control" of part of the dump, charging people for the right to scavenge on his terrain. By 1889 a large part of the dump was controlled by a "dump trust" of six people who employed "6 men at $9 per week" as scavengers. Garbage was hauled to the dump by as many as 300 teams of horse-drawn drays daily from the industrial sites of the South of Market area and many of the City's prosperous residential neighborhoods.

"Dumpville" persisted until 1895 when the police raided the area and removed 150 vagrant scavengers and hobos who called the place home. The San Francisco Call reported: "The great trouble with Dumpville was that it happened to have been located on land belonging to the Southern Pacific and its citizens had no real resources of their own." The railroads complained about the theft of lumber and freight from their yards and warehouses and thus pressure to evict the scavengers and hobos became inevitable./26/

The Decline of Industrial Diversity: The Twentieth Century

By the early 20th century, the industrial diversity of the Project Area declined but Southern Pacific had expanded its facilities, lumber companies increased their presence and warehouse facilities also continued to be a major factor in the area.

The main new business in this area was the Atchison, Topeka and Santa Fe Railway (Santa Fe). Active in Southern California since the 1880s, Santa Fe decided in the 1890s to expand into Central California -- the stronghold of a key competitor, the Southern Pacific Railroad. This decision presented a problem since the logical terminus for Santa Fe's northern branch was San Francisco, a city where the large land area required for an engine terminal and yards were unavailable at an acceptable price. Santa Fe solved this problem by establishing its main engine terminal and yards at Richmond, across the Bay from San Francisco, and leasing Mission Bay land in the eastern part of the Project Area for a freight terminal./27,28/ Consequently, during the turn-of-the-century period, Santa Fe built a seawall around a 24-acre parcel in the China Basin area. This parcel was mostly east of Illinois Street, but also was east of Kentucky Street (now Third Street), north of where Fourth Street meets Third. Santa Fe then filled the area with about four-million cubic feet of rock and other fill. Yards, tracks, freight warehouses, a small roundhouse and a freight ferry slip were then constructed and service began in July 1900./27/

In addition to the Santa Fe development in this area, a number of warehouses for storing oil, agricultural implements, machinery, lime and other items, were built adjacent to the Santa Fe spur tracks along Illinois, Michigan, Georgia, Fourth and Alameda Streets.

The emergence of the California oil industry in the 1890s and the development of hydroelectric power made the State energy self-sufficient by the early 20th century when

Los Angeles supplanted San Francisco as the oil center of California and became the largest oil port in the world./29/ While most of the oil in the Bay Area was refined in the East Bay, mainly in Richmond, large storage facilities were established in San Francisco in the Project Area due to the area's excellent transportation accessibility and the availability of undeveloped land south of China Basin Channel.

Another factor determining the location of oil storage facilities in the Project Area was the connection between Southern Pacific and early oil development in California. In 1919, the Southern Pacific Land Company owned more than 19% of the proven oil land in California and through its controlling interest in the Associated Oil Company, Southern Pacific produced about 18% of the state's oil./30/ Consequently, Associated Oil had a large storage facility in the Project Area, where Southern Pacific was the principal landholder.

Standard Oil Company, a giant of the California oil industry, had oil warehouses and supply tanks between Irwin and Hubbell Streets on the west side of Seventh Street adjacent to the Project Area. The titan of the nation's oil industry in the late 19th century, Standard began producing and refining operations in the West in 1900, when it acquired control of the Pacific Coast Oil Company. Despite an antitrust decision against it in 1911, Standard remained effectively in control of its constituent companies and subsequently became the largest refiner of oil on the Pacific Coast.

Along with the expansion of these major industries, other smaller firms and industries had a major presence in 1913. George Windeler's Cooperage, which manufactured wine casks, barrels, kegs, tanks, and clarifiers for brewers, was located on the north side of Berry Street between Third and Fourth Streets. It was one of the few businesses that survived from the late 1880s until 1913. The Roche Harbor Lime Warehouse Company was located on the south side of Berry Street between Third and Fourth Streets. The California Lime and Hydrate Company was located on what is now China Basin Street near the extended line of El Dorado Street.

The Municipal Pipeyard was located on the east side of Sixth Street about two blocks south of China Basin Channel near Irwin Street. The Pacific Coast Glass Works lay outside the Project Area, west of Seventh Street between Hooper and Irwin Streets.

The Pacific Rolling Mill Company was one of the oldest industries in the area. It began operations in 1868 and was still a flourishing iron and steel factory in 1913./31/ It was located outside the Project Area on the block bounded by 17th, Mariposa, Mississippi, and Texas Streets. The Pacific Refining and Roofing Company, located outside the Project Area, shared the block bounded by 16th, 17th, Texas, and Mississippi Streets with the Pacific Rolling Mill Company.

During the Depression of the 1930s, federal government-funded public works became an important source of both development and employment in California and the Bay Area. In the Project Area, under these programs, two new drawbridges were built across China Basin Channel, which are still standing at Third and Fourth Streets. The Lefty O'Doul Bridge on Third Street is a heel-trunnion bascule iron drawbridge and was built in 1933 by the Straus Engineering Company./32,33/ The Peter Maloney Bridge on Fourth Street was also built in the 1930s, and both bridges have been determined eligible for the National Register of Historic Places./34,35/

Southern Pacific, with its rows of tracks and sheds, continued to occupy the area north of Berry Street in the 20th century. The area south of China Basin Channel, between Sixth and Illinois Streets almost to Mariposa Street, was then crisscrossed by Southern Pacific tracks, relatively few new tracks or buildings were built after 1913. A notable exception was the construction of the China Basin Building bordering the north side of the Channel. Almost the entire block had been previously occupied by the Hauptmann Lumber Company. One block to the north, Southern Pacific displaced the MacDonald Lumber Company with a row of block-long concrete sheds.

Lumber companies were still present near China Basin Channel and steam schooners continued to serve the lumber yards into the 1920s./36/ The Rolando Lumber Company owned most of the block on the north side of China Basin Channel between Fourth and Fifth Streets. Areas on the north and south sides of the channel held lumber storage buildings, but it is not evident who owned those lumberyards or whether they belonged to the remaining lumber companies in the area. On the south side of the channel, three lumber companies were present: between Sixth and Seventh Streets, the Acme Lumber Company and the Holmes Planing Mill Company; and between Fourth and Fifth Streets, the Smith Lumber Company. One block eastward, a newcomer to the Project Area, the United Fruit Company, erected a large L-shaped building.

Along the northwest periphery of the Project Area boundary west of Seventh Street were W.R. Ames Sheet Metal Works, the Pacific Glass Works, the Holmes Lime Company, and the Whittier-Coburn Companies Paint and Oil Works. To the south, west of Seventh Street between Irwin and Hubbell Streets, were the Standard Oil Company of California's warehouse and supply tanks.

As in 1913, the central part of the Project Area remained relatively undeveloped with the exception of Southern Pacific tracks. On the southern boundary there was more development in the area. Southern Pacific's large engine roundhouse was present on the north side of Mariposa Street between Tennessee Street and Pennsylvania Avenue. One block to the east, the Bethlehem Steel Company established a steel depot.

South of Mariposa Street between Iowa and Illinois Streets, outside the Project Area, were several important new businesses including Norwalk Company's oil distribution plant, Crescent Pacific Oil Company, General Petroleum Company, and Hockwald Chemical Company.

In the southeastern section of the Project Area east of Illinois Street (roughly between where 17th and El Dorado Streets intersect Illinois), Associated Oil and Union Oil companies occupied the same premises that they had in 1913. To the north, on the block bounded by El Dorado, Illinois, Alameda Streets, and the Bay, large warehouse facilities had been built, with the China Basin Warehouses occupying the Bay front.

There was a relative lack of new development in the Project Area between 1913 and 1949. It is possible that some temporary development associated with war-related industries, such as shipbuilding and warehousing, may have taken place in the area between Illinois Street and the Bay, but most World War II-related industries developed in other parts of the San Francisco Bay region; in the City, they tended to locate on the waterfront south of the Project Area. The completion of the Bay Bridge in 1936 and the war economy of the 1940s accelerated decentralization of industry away from San Francisco.

Southern Pacific and Santa Fe tracks through or near large areas of undeveloped land may have preempted or discouraged further development. Southern Pacific and Santa Fe did not expand their facilities in this period, reflecting the "automobilization" of America, competition from the trucking industry by the 1940s, and decentralization of industry and freight business in the Bay Area.

IMPACT/37/

POTENTIAL ARCHAEOLOGICAL AND HISTORIC RESOURCES

Major cultural history periods have been discussed on pp. VI.J.1–VI.J.13. The Potential Archaeological and Historic Resources discussion summarizes the overall potential for the occurrence of archaeological sites, features, and structures that relate to those cultural periods. The Potential for Significant Resources discussion focuses on those resources that may be regarded as significant and subject to mitigation requirements under the National Historic Preservation Act or City of San Francisco landmarks preservation guidelines. Impacts on Cultural Resources are described for full build-out of the Project Area in 2020 to reflect worst-case effects on potentially significant resources.

Prehistoric Archaeological Resources

No recorded archaeological sites dating from the Prehistoric (2500 B.C. to A.D. 1500) or Protohistoric (1500s to 1700s) periods are located within the Mission Bay Project Area. The closest recorded resource is about 1,500 feet away. Most of the Project Area lay beneath the waters of Mission Bay during those times. However, three pre-fill land areas on the shore of Mission Bay in the Project Area are regarded as potential locations for prehistoric archaeological sites: the south tip of Steamboat Point, south of the present intersection of Townsend and Third Streets; the north shore of Mission Creek where it entered Mission Bay, southeast of the present intersection of Townsend and Seventh Streets; and the northern end of Point San Quentin, north of the present Mariposa Street, between Pennsylvania Avenue and China Basin Street. The end of Mission Creek (now the westerly end of China Basin Channel) would have consisted of marshlands with less archaeological sensitivity. The Steamboat Point and Point San Quentin areas would be more likely locations for prehistoric habitation and resource gathering encampments.

Although the remainder of the Project Area has a low potential for encountering prehistoric cultural resources, the possibility of encountering prehistoric archaeological sites in this area cannot be totally dismissed./38/ Mission Bay was shallow throughout its existence, and it is possible that very early prehistoric sites (pre-2500 B.C.) may have been located along the perennial Mission Creek drainage in areas which were subsequently covered by Bay waters. Such sites would pre-date the historic configuration of San Francisco Bay and would be of considerable antiquity. The discovery of such a cultural resource would contribute greatly to the understanding of San Francisco's prehistory.

Historic Archaeological Resources

During the 1770s-1860s era, Mission Bay was almost entirely under water and only one known location may have significant deposits of cultural resources dating to these years: the Steamboat Point area, in the two blocks bounded by Third, Fourth, Townsend, and Berry Streets. The main part of Steamboat Point was between Third, Fourth, Townsend and King Streets, but the tip of Steamboat Point extended past the line later formed by King Street and into the Berry, King, Third and Fourth Streets block. The Steamboat Point area consisted of shipyards during the 1850s and early 1860s, and early maps and City directories show various buildings and dwellings in the area during this period. Subsurface remains of Gold Rush period shipyards, building foundations, historic artifacts and trash dumps could be located in that area. Since shipping and shipbuilding were important activities, there is also the remote possibility of encountering undocumented buried ship remains. Also, the presence of a Chinese fishing village near Bryant and Second Streets close to Steamboat Point suggests the possibility of Chinese maritime remains and other artifacts in that section of the Project Area.

During the last four decades of the 19th century, Mission Bay underwent extensive filling and the Project Area developed into a diversified industrial area with a variety of enterprises. Included were shipbuilding, glass-making, chemical manufacturing, lumber production and related industries, railroad operation, a major dump, oil operations and food processing as well as other enterprises. Three types of industries stand out as resulting in potentially significant historic archaeological areas; these are glass-making, shipbuilding and the dump.

By the early part of the 20th century, Mission Bay had been completely filled. Industrial diversity of the area was decreased; industries prominent in the Project Area during the 20th century -- such as oil, lumber and railroads -- were not likely to leave important subsurface cultural resources.

Historic Structures

Previous studies have identified the following buildings or structures as possessing potential historic significance: the Third and Fourth Street Bridges dating from the 1930s, and the cut-basalt block pavement dating from the 1890s on King Street between Third and Seventh, and Sixth south of King Street./39/ In addition, The Foundation for

San Francisco's Architectural Heritage identified several potential historic properties./40/ Those properties were later found to be ineligible for National Register consideration or to have been demolished./41/ Field review revealed little potential for archaeological remains or artifacts at those locations. The basalt block pavement was considered of local historical importance in previous surveys but would not be eligible for the National Register./42,43/

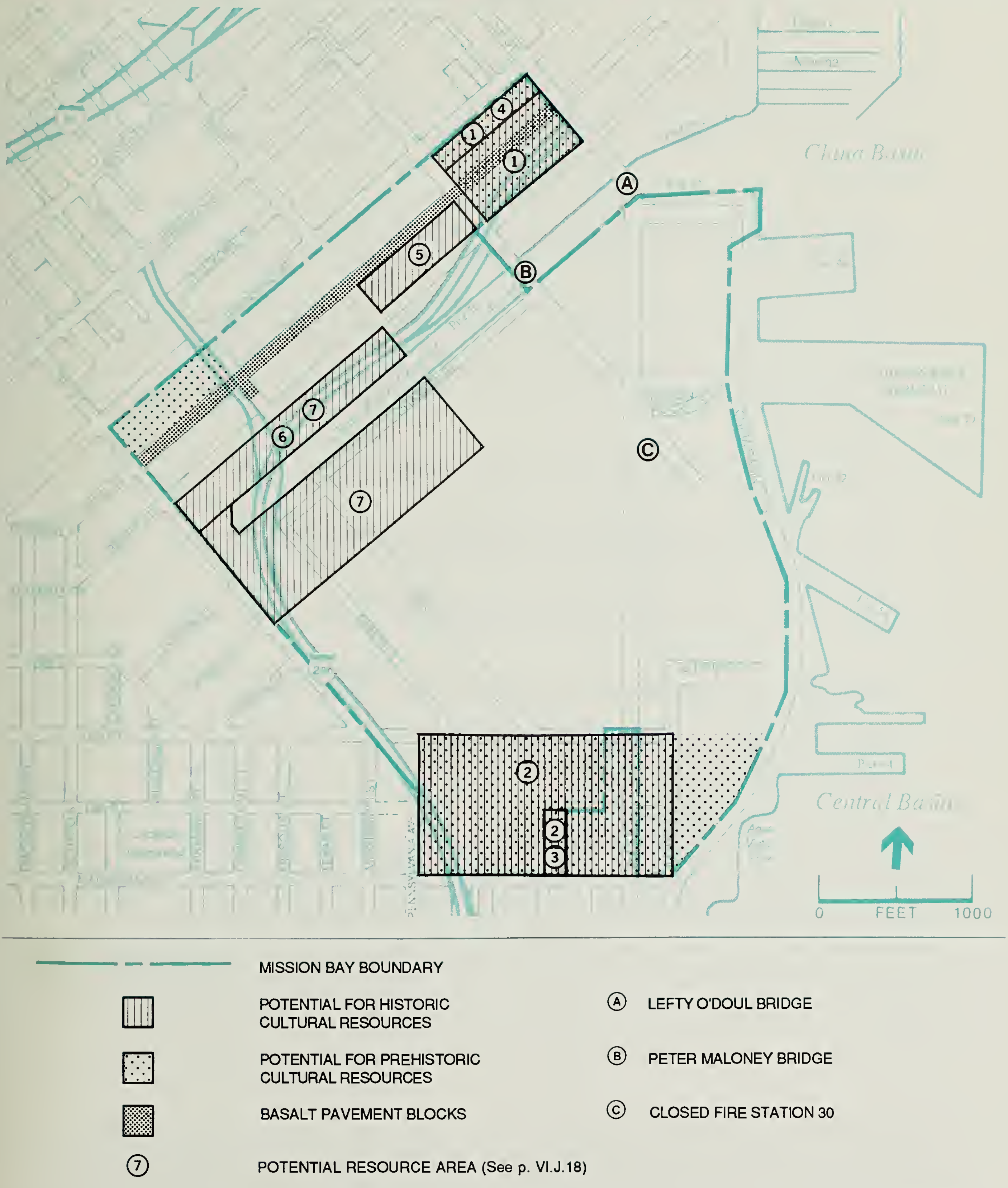
One structure within the Project Area was observed that may be of historical importance: closed Fire Station 30, at the southeast corner of the intersection of Third and Mission Rock Streets; the station may be eligible for listing on the National Register (see VI.I. Architectural Resources and Urban Design, p. VI.I.4). Other existing structures and features in the Project Area are of recent origins and no older than 50 years, generally the required age for structures to be considered by the State Historic Preservation Officer for National Register eligibility (although special circumstances can apply to buildings of lesser age).

POTENTIAL FOR SIGNIFICANT RESOURCES

Mission Bay development may disturb possible cultural resources considered significant under criteria for the National Register of Historic Places. Significant resources are those historic and archaeological properties that are listed on the National Register or are potentially eligible for such listing./44/ Department of Interior regulations describe National Register criteria for listing, and provide the context for impact and mitigation discussions./45/

There is no archival evidence to suggest that prehistoric cultural deposits are actually present at Steamboat Point, Point San Quentin or the end of Mission Creek. Therefore, the potential for impacts on significant prehistoric resources at those three locations is considered to be low (see Figure VI.J.1). The potential for encountering Chinese maritime artifacts near Steamboat Point is also considered to be low. Because of the low potential for encountering prehistoric or Chinese maritime cultural resources in the Project Area, those resources are not discussed further in this impact analysis.

Numerous cultural developments, industries and enterprises and specific activity locations throughout the history of the Project Area are identified on pp. VI.J.4–VI.J.13. Many of the described areas would not contain associated cultural deposits, features or artifacts,


China Basin
Central Basin
A
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C
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FEET
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MISSION BAY BOUNDARY
▥ POTENTIAL FOR HISTORIC CULTURAL RESOURCES
⁘ POTENTIAL FOR PREHISTORIC CULTURAL RESOURCES
▩ BASALT PAVEMENT BLOCKS
⑦ POTENTIAL RESOURCE AREA (See p. VI.J.18)
Ⓐ LEFTY O'DOUL BRIDGE
Ⓑ PETER MALONEY BRIDGE
Ⓒ CLOSED FIRE STATION 30

Mission Bay

SOURCE: David Chavez & Associates

FIGURE VI.J.1
CULTURAL RESOURCES POTENTIAL

and it is not likely that many of those areas that do contain cultural remains could be regarded as significant historic resources under National Register criteria./45/ However, the areas that may contain potentially significant historical archaeological deposits include:

1. Steamboat Point, a shipbuilding area of the 1850s and early 1860s. Steamboat Point was located in the two blocks bounded by Third, Fourth, Townsend and Berry Streets.

2. Point San Quentin/Point Potrero, another early shipbuilding area, occupied beginning in the early 1860s, defined by 16th Street, Illinois Street, Mariposa Street and Pennsylvania Avenue. This area includes the 1860s to 1880s shipbuilding yards of P.H. Tiernan and the Dickie Brothers at Third and Mariposa Streets.

3. The east side of Minnesota Street between Mariposa and 17th Streets -- the location of the Pacific Glass Works (1863 to 1876).

4. The south side of Townsend Street between Third and Fourth Streets -- the original site of San Francisco Glass Works (1865 to 1870).

5. The block bounded by King, Berry, Fourth, and Fifth Streets -- the second location of the San Francisco Glass Works (1870 to 1886).

6. The south side of Berry Street between Fifth and Seventh Streets -- the area of shipbuilding yards of Alexander Hay and Boole and Beaton (1880s).

7. The area bordered by Berry, Fifth and Seventh Streets, south to where a line extended from Irwin Street would meet Fifth Street -- the City dump from the 1870s to the early 1890s.

Those seven potential historic archaeological locations could be disturbed by land alteration activities (grading, trenching, excavation) for Mission Bay building construction and the removal of the I-280 stub. All Alternatives would involve new construction in areas where historic archaeological deposits are potentially located. Disturbance or removal of soils containing archaeological features and artifacts would destroy the archaeological integrity of the deposits, thus diminishing research potential and the ability of those deposits to yield information important in history.

Construction activities along King and Sixth Streets with all Alternatives would affect the basalt pavement; the architectural integrity and historical importance of Fire Station 30 could be adversely affected by changes in use proposed in Alternatives A and N, or demolition proposed in Alternative B.

BUILD-OUT/2020

Alternative A

By the year 2020, development north of the channel would include the six-block area of office, MHDR, and retail uses bounded by Townsend, Third, Berry, and Sixth Streets, and removal of the I-280 stub that could disturb potential historic archaeological resources at Steamboat Point. Construction in the Townsend, Third, King, and Fourth Streets block could disturb possible archaeological deposits from the 1865 to 1870 San Francisco Glass Works and development in the King, Fourth, Berry and Fifth Streets block could disturb archaeological deposits associated with the second, 1870 to 1886 operation of the San Francisco Glass Works. HDR, open space, and S/LI/RD development bounded by the channel and Berry, Fifth, and Seventh Streets could disturb archaeological deposits associated with 1880s shipbuilding yards of Alexander Hay and Boole and Beaton, and artifacts from the dump. Street improvements on King and Sixth Streets and MUNI-Metro construction on King Street would disturb the basalt pavement.

Housing, open space, and S/LI/RD development south of the channel could disturb historic artifacts from the dump. Dredging and edge improvements along China Basin Channel between Seventh and Fifth Streets could disturb artifacts from the dump. S/LI/RD development in the area bounded by 16th, Illinois, Mariposa, and Pennsylvania Streets could disturb potential archaeological deposits from the 1860's to 1880's Point San Quentin shipbuilding operations, including the yards of P.H. Tiernan and the Dickie Brothers, and from the 1860's and 1870's Pacfic Glass Works.

The rehabilitation and reuse of closed Fire Station 30 as a community facility could affect the building's architectural integrity.

Initial Phase of Development

The initial phase of development could affect potential cultural resources at two locations. Office and retail buildings in the easterly half of the Townsend-Third-King-Fourth Streets block could disturb possible historic archaeological deposits associated with the 1850's and early 1860's Steamboat Point shipbuilding industry and the original location of the San Francisco Glass Works.

Alternative B

Development north of the channel would include the eight-block area of MHDR structures bounded by Townsend, Third, Berry and Seventh Streets, and removal of the I-280 stub. As with Alternative A, construction in the two-block area bounded by Townsend, Third, Berry and Fourth Streets could disturb possible archaeological deposits associated with the 1850s and 1860s Steamboat Point shipbuilding industry. Construction in the Townsend, Third, King, and Fourth Streets block could disturb possible archaeological deposits from the 1865 to 1870 San Francisco Glass Works; and in the King, Fourth, Berry, and Fifth Streets block, possible historic archaeological deposits associated with the second location of the San Francisco Glass Works (1870 to 1886). Road improvements and MUNI-Metro extension on King and Sixth Streets would disturb the basalt pavement.

The proposed open space north of the channel and south of Berry between Fifth and Seventh Streets is the location of late 19th-century shipbuilding operations; grading could disturb possible historic archaeological deposits associated with the 1880s shipbuilding yards of Alexander Hay and Boole and Beaton. Edge improvements along the channel between Seventh and Fifth could disturb artifacts from the dump.

West of Third Street, development would include office, MDR, LDR, and retail buildings north of Hubbell Street and south of Hooper Street. That area is within the southern extension of the 19th-century dump, and construction could impact historic artifacts that might be deposited there. Subsurface work to develop the mid-channel wetland could also disturb artifacts from the historic dump area. MDR, MHDR, community facilities and S/LI/RD development bounded by 16th, Illinois, Mariposa, and Pennsylvania could disturb potential historic archaeological deposits from 1860s shipyards and the 1863 to 1876 Pacific Glass Works.

The construction of a new community facility would result in the demolition of closed Fire Station 30, which may be eligible for the National Register.

Initial Phase of Development

The initial phase of development residential and office construction east of I-280, north of Hubbell Street and south of the channel, could disturb artifacts associated with the southern extension of the 19th-century dump.

Alternative N

Development north of the channel in the area bounded by Townsend, Third, Berry and Fourth Streets could disturb possible archaeological deposits associated with the 1850's and 1860's Steamboat Point shipbuilding operations and the 1865 to 1870 San Francisco Glass Works. Construction in the block bounded by King, Fourth, Berry, and Fifth Streets could disturb possible archaeological deposits from the 1870 to 1886 San Francisco Glass Works. Development in the Berry-Fifth-China-Basin Channel-Seventh area could affect possible deposits from the 1880's shipbuilding yards of Alexander Hay and Boole and Beaton and from the 19th-century dump. The basalt block pavement on King and Sixth would be disturbed as roadways were rebuilt to serve new M-2 development. M-2 development south of the channel west of Third Street could disturb historic dump artifacts. Development in the area bounded by 16th, Illinois, Mariposa, and Pennsylvania Streets could disturb possible archaeological deposits associated with 1860's and 1880's shipbuilding operations and the 1863 to 1876 Pacific Glass Works.

The reuse of closed Fire Station 30 as a community services facility could disturb the building's architectural integrity.

MITIGATION

HISTORIC ARCHAEOLOGIC RESOURCES

With the exception of some limited archaeological testing in the past, very little is known about the actual areal extent, specific nature and location of historic features and artifact caches, and depositional integrity of potential historic archaeological deposits./46,47/ Specific information of that nature is important in determining the actual significance of archaeological resources and in developing appropriate mitigation plans. Pre-construction archaeologic testing and construction monitoring would be appropriate for six of the seven identified historic resource areas; archaeologic monitoring during construction only, rather than testing, would be appropriate for the seventh area, the location of the 19th-century city dump.

Measure	Alternative	Description
J.1	A,B,N	Retain the services of an archaeologist, because of the strong possibility of encountering the remains of cultural or historic artifacts or features in the six historic resources areas. The Environmental Review Officer (ERO) in consultation with the President of the Landmarks Preservation Advisory Board (LPAB) and the archaeologist would determine: 1) whether the archaeologist should instruct all excavation and foundation crews on the project site of the potential for discovery of historic archaeological deposits and artifacts, and the procedures to be followed if such materials are uncovered; and 2) prior to the commencement of foundation excavation, a program of archaeological testing. Retain a qualified historic archaeologist to supervise a pre-foundation excavation testing program for each phase of Project Area development or each construction site, as appropriate, using a series of mechanical, exploratory borings or other testing methods determined by the archaeologist to be appropriate. A qualified historical

Measure	Alternative	Description
		archaeologist would supervise the testing at the site to determine the probability of finding cultural and historical remains. At the completion of the archaeological testing program, the archaeologist would submit a written report first and directly to the ERO and the President of the LPAB, with a copy to the project sponsor, which describes the findings, assesses their significance and proposes appropriate recommendations for any additional procedures necessary for the mitigation of adverse impacts to cultural resources determined to be significant.
		Retain a certified archaeologist to supervise a program of on-site monitoring during site excavation in the six historic resource areas, following site clearance and pre-excavation testing. The certified archaeologist would record observations in a permanent log. Should cultural or historic artifacts be found following commencement of excavation activities, the archaeologist would assess the significance of the find, and immediately report to the ERO and the President of LPAB. Upon receiving the advice of the consultants and the LPAB, the ERO would recommend specific mitigation measures, if necessary. The monitoring program, whether or not there are finds of significance, would result in a written report to be submitted first and directly to the ERO and the President of the LPAB, with a copy to the project sponsor.
		Suspend excavation or construction activities which might damage discovered cultural resources for a total maximum of four weeks over the course of construction at each site to permit inspection, recommendation and retrieval, if appropriate.

Measure	Alternative	Description
• J.5	B	If the closed Fire Station 30 were found to be eligible for the National Register or for City Landmark designation, demolition of the structure would require additional mitigation measures. Prepare an "Historic American Building Survey", including the precise recording of the structure through measurements, drawings and photographs. Provide sufficient detail in the documentation such that after demolition, the historical structure could be reconstructed from the survey data. File copies of the records and documents with the appropriate federal, state and city agencies. Include in the mitigation program salvage and selective re-use of building materials once the survey is completed. Upon completion, a copy of the report would be provided to the Environmental Review Officer in the San Francisco Department of City Planning and the President of the San Francisco Landmarks Preservation Advisory Board. If Station 30 were preserved as part of Alternative B, that could require a realignment of the proposed extension of Fourth Street east of Third. As now planned, that southeasterly extension would require right-of-way through the site of closed Station 30. (See Figure V.2, p. V.14) The realignment would not alter the overall configuration of streets or land uses in Alternative B.
J.6	A,B,N	Leave the cut-basalt pavement on King and Sixth Streets, or portions of it, intact and incorporate it as an historical feature of interest; or remove and store the pavement and use it as road or pathway material in other Mission Bay locations for pedestrian walkway borders, parks or plazas. An alternative measure would be to remove the blocks for later use in other parts of the City; that would be consistent with the San Francisco Department of Public Works policy for historic basalt block pavements./48/

OTHER CULTURAL RESOURCES

Measure	Alternative	Description
J.7	A,B,N	The entire Mission Bay Project Area has at least some sensitivity for the presence of unknown archaeological remains. Prehistoric cultural deposits could be encountered in three identified areas and unknown historical features, artifact caches and debris areas could be located anywhere in the Project Area. Follow procedures for instructing excavation crews, notifying the ERO and President of the LPAB, and developing recovery measures, as described in J.1., above. In addition, in the event that prehistoric archaeological deposits are discovered, consult local Native American organizations. Dialogue with the ERO, LPAB and the archaeological consultant would take place in developing acceptable archaeological testing and excavation procedures, particularly in regard to the disposition of cultural materials and Native American burials.

NOTES

SETTING

/1/ Levy, R., Handbook of North American Indians, Edited by Robert F. Heizer, Smithsonian Institution, Washington, D.C., 1978, Volume 8, pp. 485-595. Linguistic evidence suggests that the immediate ancestors of the historically known Costanoan people moved into the San Francisco region around A.D. 500, and likely migrated from the San Joaquin-Sacramento River Delta area. This theory of Costanoan language arrival into the San Francisco area is chronologically consistent with the appearance of Late Horizon artifact assemblages in archaeological sites in the Bay Area.

/2/ Sharpsteen, W., "Vanished Waters of Southeastern San Francisco: Note on Mission Bay and the Marshes and Creeks of the Potreros and the Bernal Rancho," California Historical Society Quarterly, 1942, 21(2):113-126.

/3/ Dow, G., Bay Fill in San Francisco: A History of Change, Master's Thesis, San Francisco State University, 1973, p. 118.

/4/ Bay Fill in San Francisco: A History of Change, pp. 117-118.

/5/ Bay Fill in San Francisco: A History of Change, p. 119.

/6/ Olmsted, R., N. Olmsted, D. Fredrickson and V. Bente, San Francisco Bayside: Historic Cultural Resource Survey, San Francisco Clean Water Program, 1982, p. 186.

/7/ Young, J., San Francisco: A History of the Pacific Coast Metropolis, Two Volumes, The S. J. Clarke Publishing Company, San Francisco, 1912, Volume 1, p. 37.

/8/ San Francisco Bayside: Historic Cultural Resource Survey, p. 220.

/9/ Langley, H., The San Francisco City Directory, various publishers, San Francisco, 1858 and 1860.

/10/ Wirth Associates, Inc., "Potrero 7 Phase I: Cultural Resources Overview and History," prepared for Pacific Gas & Electric Company, San Francisco, 1979, p. 79.

/11/ Lockwood, C., Suddenly San Francisco: The Early Years of an Instant City, San Francisco, 1978, p. 83.

/12/ Suddenly San Francisco, p. 85.

/13/ Gensoul, A., "Railroad Map of the City of San Francisco," Britton and Company, San Francisco, undated.

/14/ Britton and Company, "Railroad Map of the City of San Francisco," San Francisco Directory, San Francisco, 1864.

/15/ Olmsted, R., N. Olmsted and A. Pastron, San Francisco Waterfront: Report on Historic Cultural Resources, San Francisco Wastewater Management Program, San Francisco, 1977, p. 89.

/16/ The San Francisco City Directory, 1873:17.

/17/ Bay Fill in San Francisco: A History of Change, pp. 129-130.

/18/ San Francisco Waterfront: Report on Historic Cultural Resources, p. 197.

/19/ San Francisco Waterfront: Report on Historic Cultural Resources, p. 95.

/20/ San Francisco Waterfront: Report on Historic Cultural Resources, p. 77.

/21/ San Francisco Bayside: Historic Cultural Resource Survey, p. 191.

/22/ San Francisco Waterfront: Report on Historic Cultural Resources, pp. 57, 62 and 72.

/23/ San Francisco Waterfront: Report on Historic Cultural Resources, p. 58.

/24/ San Francisco Waterfront: Report on Historic Cultural Resources, pp. 92-95.

/25/ Suddenly San Francisco, p. 148.

/26/ San Francisco Bayside: Historic Cultural Resource Survey, p. 224.

/27/ Bryant, K., History of the Atchison, Topeka and Santa Fe Railway, MacMillan Publishing Company, New York, 1974, p. 180.

/28/ Duke, D. and S. Kistler, Sante Fe: Steel Rails Through California, Golden West Books, 1963, San Marino, p. 161.

/29/ Bean, W., California: An Interpretive History, McGraw-Hill Book Company, New York, 1973, p. 373.

/30/ California: An Interpretive History, pp. 372-373.

/31/ Hackett, F., ed., The Industries of San Francisco: Her Rank, Resources, Advantages, Trade, Commerce and Manufactures, Conditions of the Past, Present and Future, Representative Industrial Institutions, Historical Descriptive and Statistical, Payot, Upham and Company, San Francisco, 1884, p. 57.

/32/ Banks, P. "An Evaluation of the Cultural Resources Within the Mission Bay San Francisco Project, City and County of San Francisco, California," prepared for Jefferson Associates, 1983, p. 14.

/33/ Alden, D., "Historic Evaluation of the Third Street Bridge Over Mission Channel Waterway at China Basin, City of San Francisco," City and County of San Francisco Department of Public Works, 1985, p. 13-14.

"The bridge over the China Basin Channel on Third Street . . . has integrity of location, design, setting, materials, workmanship, feeling and association. Rehabilitation work done over the years has had insignificant impact on this integrity.

"It is closely associated with the life of a renowned bridge designer, Joseph B. Strauss, who was heavily involved with the planning of the Golden Gate Bridge at the very time that the Third Street Bridge was being built. The bridge is of (a) type . . . that first brought fame to Strauss and is the only bridge of this type in the immediate vicinity of San Francisco.

"Based on the foregoing, the Third Street Bridge appears to meet the National Register criteria . . . for listing on the National Register of Historic Places."

/34/ Mikesell, S., "Truss Bridge Rating Sheet: Bridge No. 34C-27, San Francisco," Caltrans, Sacramento, 1985.

"The Fourth Street Bridge is the only California example of the Strauss Overhead Counterweight Bascule Bridge, an early design by master bridge designer, J.B. Strauss. It is also the only extant bridge in California constructed by the Thomson Bridge Company, a pioneer San Francisco bridge builder. Historically, the bridge was a key link in the transportation network of the Port of San Francisco."

/35/ Mikesell, S., Caltrans Architectural Historian, Sacramento, telephone conversation, September 17, 1986.

/36/ Olmsted, N., Vanished Waters: A History of San Francisco's Mission Bay, Mission Creek Conservancy, San Francisco, 1986, p. 59.

IMPACT

/37/ The Cultural and Historic Resources impact analysis is based on a report, "Cultural Resources Evaluation for the Mission Bay Project, San Francisco, California," December 1987, prepared by David Chavez & Associates, cultural resource consultants, for Environmental Science Associates, Inc. The Chavez study included archival research at university, state, City of San Francisco, museum and historical society libraries; review of secondary sources previously published on cultural resources of the San Francisco waterfront; historic Sanborn Maps and City directories; contacts with private and public agency historians and archaeologists; and a field reconnaissance of the Project Area.

/38/ "An Evaluation of the Cultural Resources Within the Mission Bay San Francisco Project, City and County of San Francisco, California," 1983, p. 6.

/39/ "An Evaluation of the Cultural Resources Within the Mission Bay San Francisco Project, City and County of San Francisco, California," pp. 13-14.

/40/ Christopher H. Nelson, Architectural Historian, The Foundation for San Francisco's Architectural Heritage, interview, September 22, 1986. Heritage identified the following as potential historic properties: the Southern Pacific engine roundhouse site on the north side of Mariposa Street between Tennessee and Pennsylvania Streets; the Montague Plant building site, which dated from the turn of the century and, as of 1949, was on the northwest corner of Mariposa and Third Streets; and four Southern Pacific freight sheds on King and Berry Streets between Fourth and Sixth Streets. An historical architecture survey of the area for the I-280 transfer concept determined that the sheds were not eligible for the National Register; they were subsequently demolished in 1986. A field review of the Project Area in September 1986 confirmed that no artifacts of the long-demolished Southern Pacific engine roundhouse and the Montague Plant building remain.

/41/ J. Snyder, "Historic Architectural Survey Report for I-280 Transfer Concept," CalTrans, Sacramento, 1983, p. 4.

/42/ San Francisco Waterfront: Report on Historic Cultural Resources, p. 133.

/43/ "An Evaluation of the Cultural Resources Within the Mission Bay San Francisco Project, City and County of San Francisco, California," 1983, p. 33.

/44/ "36 CFR Part 800: Protection of Historic Properties Regulations of the Advisory Council on Historic Preservation Governing the Section 106 Review Process." Advisory Council on Historic Preservation, Washington, D.C., Effective October 1, 1986.

/45/ "Section 106, Step by Step." Advisory Council on Historic Preservation, Washington, D.C., October 1986. "The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that (a) are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction; or (d) that have yielded or may be likely to yield information important in history or prehistory."

MITIGATION

/46/ Wirth Associates, Inc., "Potrero 7 Phase II: Archaeological Test Excavations," prepared for Pacific Gas & Electric Company, San Francisco, 1979.

/47/ Pastron A. et al., "Behind the Seawall." Three Volumes. San Francisco Clean Water Program, San Francisco, 1981.

/48/ San Francisco Waterfront: Report on Historic Cultural Resources, p. 112.

K. GEOLOGY AND SEISMICITY

SETTING

DATA REVIEW AND SITE RECONNAISSANCE

In 1982, during studies for the development of the Mission Bay site, the geotechnical consulting firm of Dames & Moore produced a preliminary report on the site in April, and a more detailed report in December which included the results of limited field work./1,2/ The following year, Harding Lawson Associates / Georesources Consultants did geotechnical analyses on possible stadium sites, several of which are on the Mission Bay site./3/ Data in these reports and other geological studies have been used extensively in this description.

Surface Topography and Geologic Materials

Surface Features

In the 1850s, Mission Bay was a shallow inlet off San Francisco Bay. The original shoreline is shown in Figure VI.N.1, p. VI.N.6 Filling of the site began after the construction of a land-fill bridge (Long Bridge) along the present alignment of Third Street. The northern shore of Mission Bay between Fifth and Seventh Streets was the only officially designated dump in San Francisco during the late 1800s. It was closed in 1895. After the earthquake and fire of 1906, rail lines were extended into the City and the debris hauled to Mission Bay where it was used to fill the area west of Long Bridge. The placement of fill and grading of the surface have left a mostly flat surface with little relief. According to the topographic map of the area, the highest elevation is nearly 20 feet at the extreme southwest corner of the site. Most of the Project Area is below San Francisco datum in elevation./4/

Geologic Structure and Materials

Like most of San Francisco, Mission Bay is underlain by the Franciscan Assemblage, a complex bedrock of ancient ocean floor materials which have been squeezed together and uplifted along the central and northern California coast./5/ The bedrock under the Project Area is composed mostly of sandstone and shale and is the same block exposed on Telegraph Hill. Immediately southwest of the site there is a severely deformed band of rocks which runs from Fort Point through Potrero Hill to Hunters Point. This deformed band, termed a shear zone, is composed mainly of serpentine and melange rocks./6/ Because the rocks from the shear zone dip northeast under the Telegraph Hill block, it is likely that the bedrock in some locations on the site consists of material from the shear zone. Varying thicknesses of younger sedimentary material and artificial fill cover the bedrock on the Project Area.

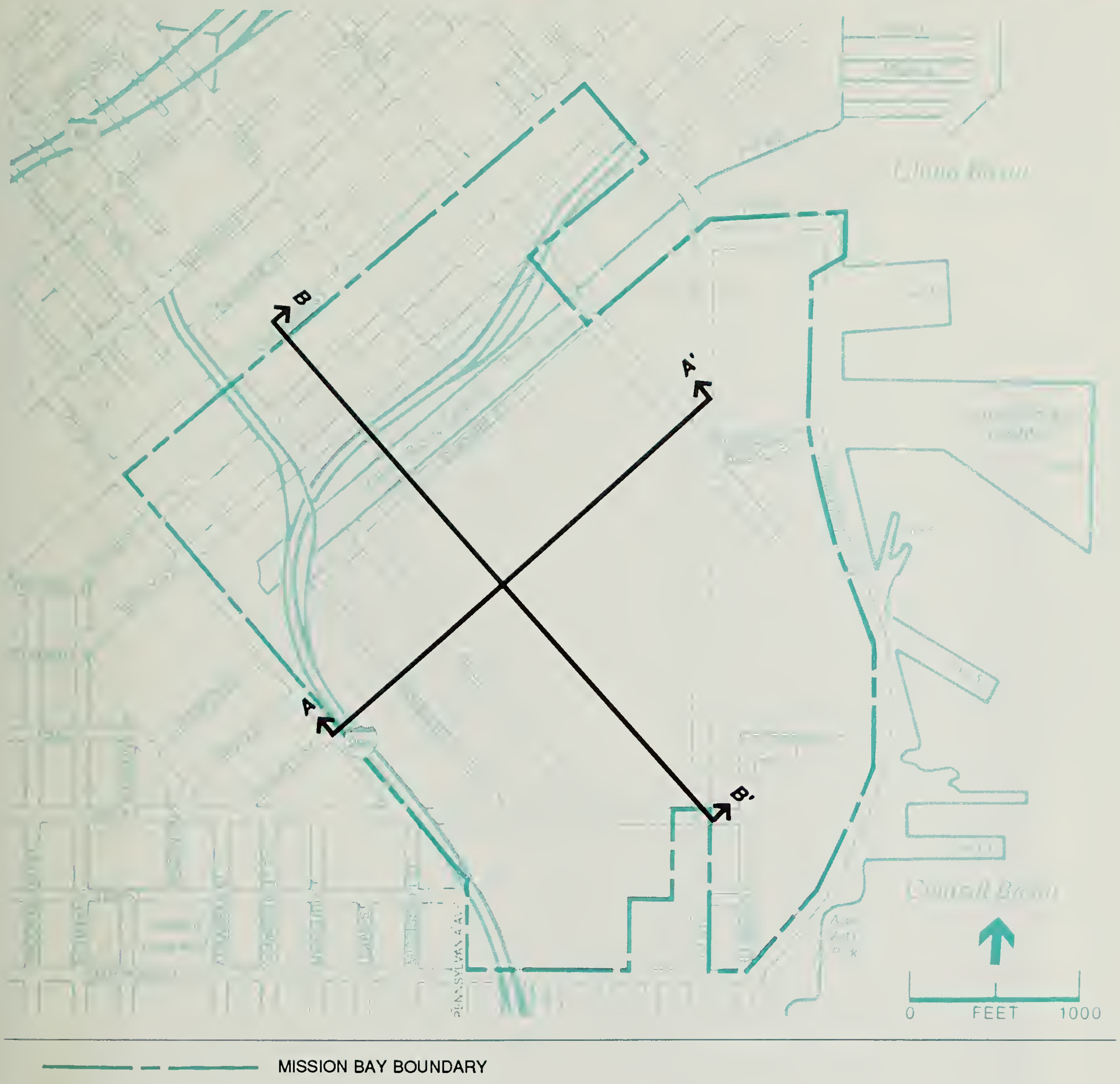
Cores drilled at the site encounter up to five different units of geologic materials. Figures VI.K.1, VI.K.2, and VI.K.3 show subsurface profiles of the Project Area. Starting with the youngest, these units are:

- Fill: Unengineered artificial fill was used to reclaim the property from the Bay, beginning in the mid-nineteenth century. The fill consists of highly variable mixtures of sands with some silts and clays, bricks, cinders, concrete rubble, and trash./1/ The density and compressibility of fill materials are highly variable and their irregular distribution causes large changes in soil behavior over small distances. In some areas behind the China Basin seawall, dredged Bay Mud was used as fill material./3/ The thickness of the unengineered fills ranges from 0 to 57 feet, with an average of 18 feet. Much of this variation is due to the creation of mud waves during the initial filling operations./2/ The nature of these fills also varies substantially within the site from clean sands to rubble. Much of the fill north of the China Basin Channel consisted of old dune sands excavated from local sources; south of the channel the fill is much more varied. In many areas it consists of old rubble, and it is not uncommon in the area to find old wood beams buried in the fill. No direct evidence of the city dump was found by Dames and Moore in any of the 12 borings on the old dump site./2/

- Bay Mud: The youngest bay sediments consist of a soft, uniform, gray, silty clay. It can be divided into two units: an older semi-consolidated member and a younger soft member. The older member is overconsolidated, but not as severely as the old bay clay. In general, both Bay Mud units are high in water content, weak and compressible, but in some locations the older Bay Mud is stiff enough to support piles. Site-specific geotechnical testing is required to determine the engineering characteristics of the older Bay Mud. The younger soft mud is also sensitive; that is, it can suddenly lose up to 50% of its strength when disturbed./7/ Figure VI.K.4, p. VI.K.6, shows isolines (similar to contour lines) indicating the thickness of Bay Mud at Mission Bay, which may be up to 100 feet thick in the central portion of the site./1/ Thickness of the Bay Mud is difficult to determine precisely; the accuracy of the thicknesses shown on Figure VI.K.4 is about ±15 feet./8/

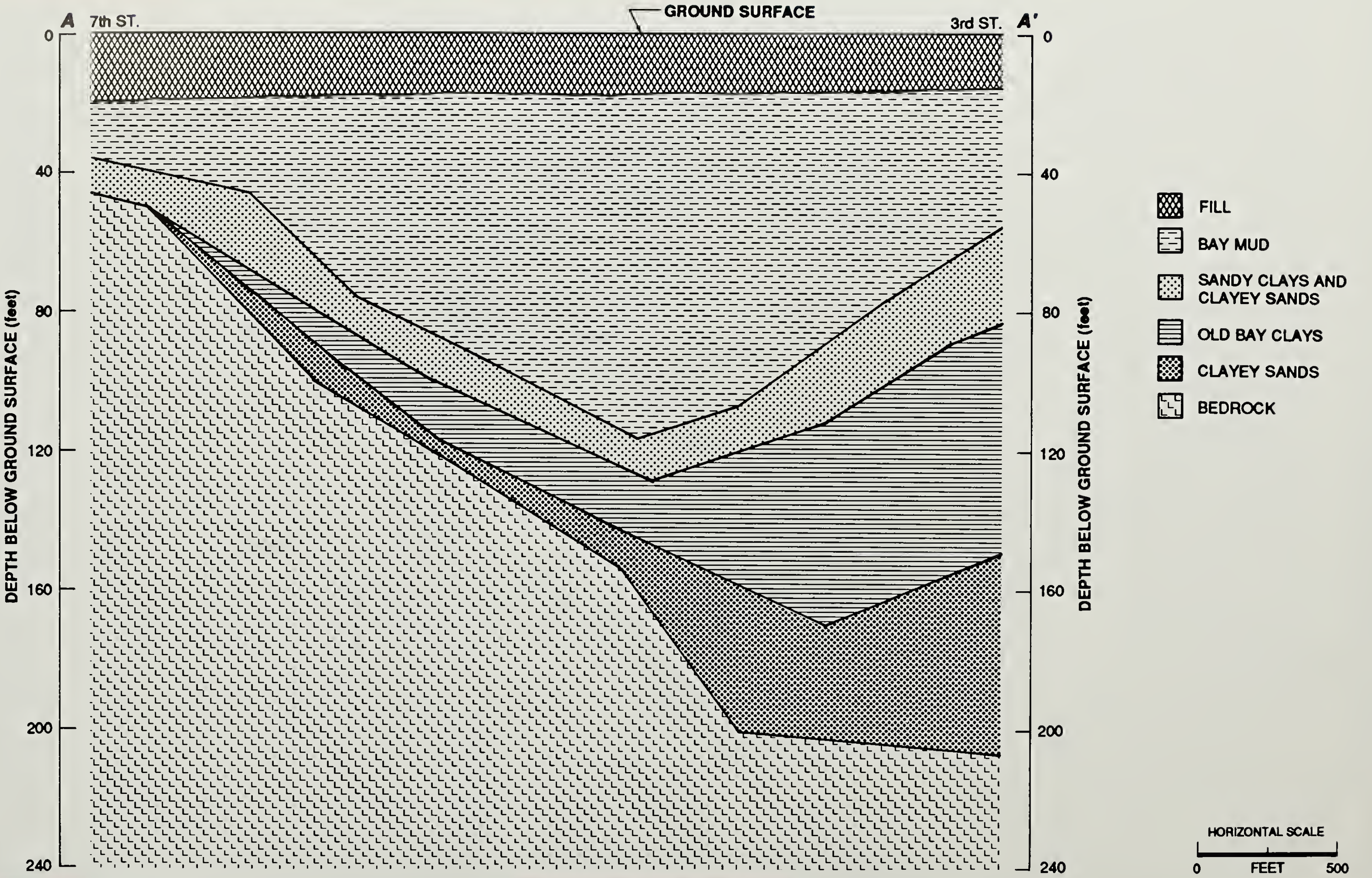
- Sand Deposits: Widespread but discontinuous sand deposits are found underlying Bay Mud. The sand frequently is cut by mud-filled channels./9/ The thickness is highly variable.

- Old Bay Clay: Old bay clay is a stiff, overconsolidated marine deposit that overlies bedrock./10/ It consists of dark greenish-gray silty clay with some interbedded sand layers./7/ In some locations it is underlain by dense clayey


B
A'
A
B'
China Basin
Channel Basin
PENNSYLVANIA AVE.
0
FEET
1000
MISSION BAY BOUNDARY

SOURCE: Dames & Moore

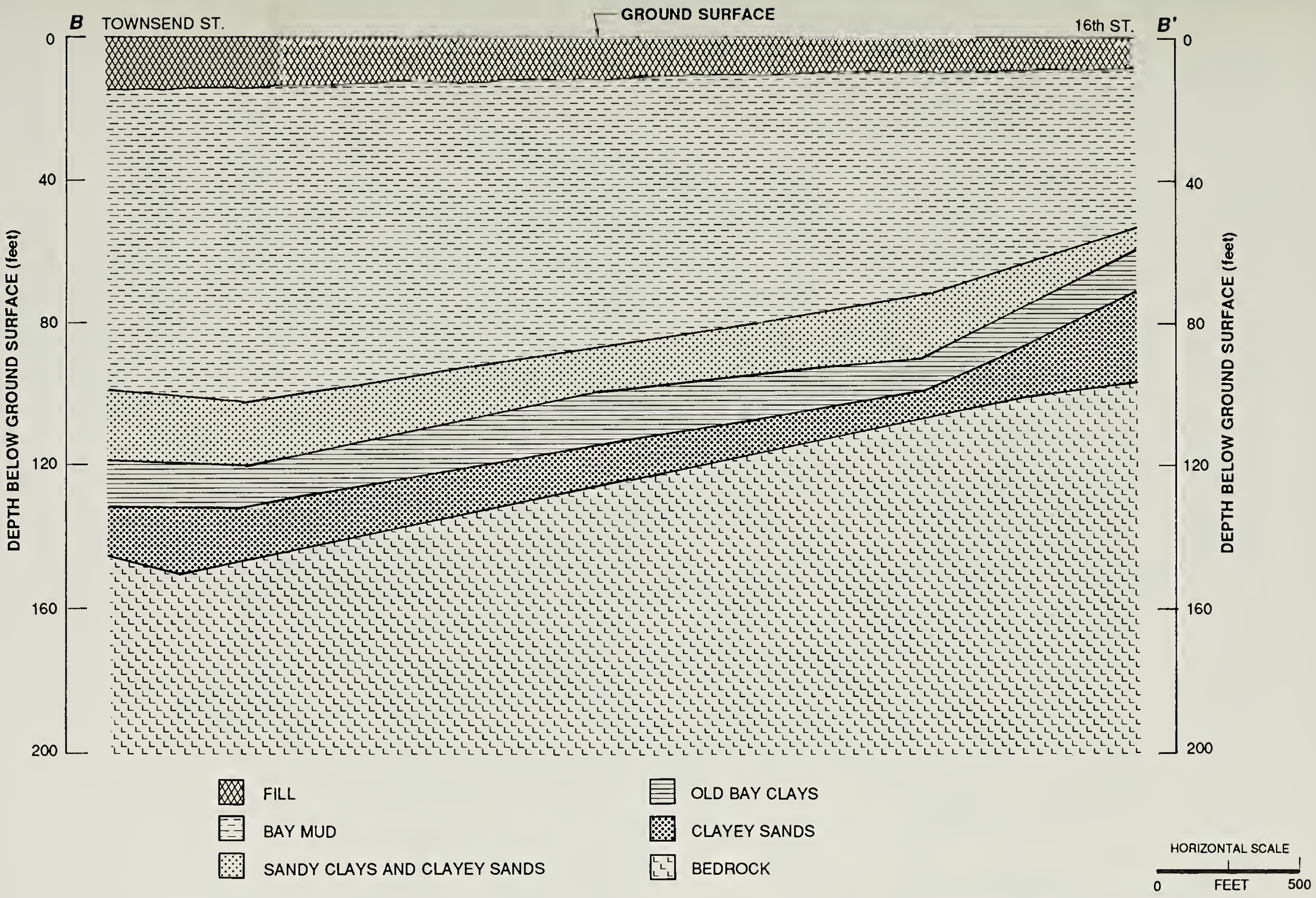
FIGURE VI.K.1
PLOT PLAN SHOWING LOCATIONS OF SUBSURFACE PROFILES


A
7th ST.
GROUND SURFACE
3rd ST.
A'
DEPTH BELOW GROUND SURFACE (feet)
0
40
80
120
160
200
240
FILL
BAY MUD
SANDY CLAYS AND CLAYEY SANDS
OLD BAY CLAYS
CLAYEY SANDS
BEDROCK
HORIZONTAL SCALE
0
FEET
500

Mission Bay

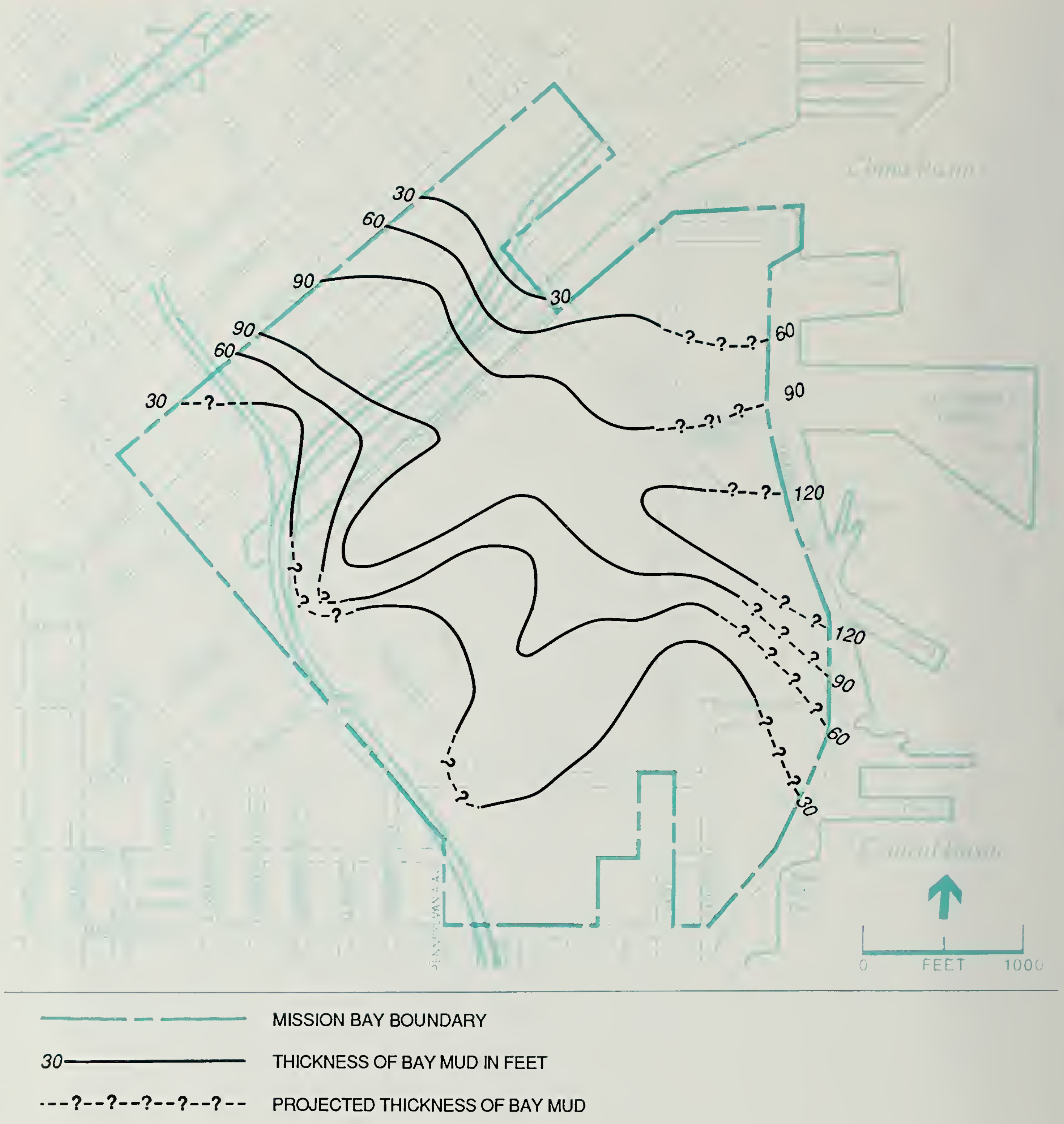
SOURCE: Dames & Moore

FIGURE VI.K.2
SUBSURFACE PROFILE
ALONG SECTION A - A'


B
TOWNSEND ST.
GROUND SURFACE
16th ST.
B'
0
40
80
120
160
200
DEPTH BELOW GROUND SURFACE (feet)
0
40
80
120
160
200
DEPTH BELOW GROUND SURFACE (feet)
FILL
BAY MUD
SANDY CLAYS AND CLAYEY SANDS
OLD BAY CLAYS
CLAYEY SANDS
BEDROCK
HORIZONTAL SCALE
0
FEET
500

SOURCE: Dames & Moore

FIGURE VI.K.3
SUBSURFACE PROFILE
ALONG SECTION B - B'


30
60
90
90
60
30
30
60
90
120
120
90
60
30
China Basin
Central Basin
0
FEET
1000
MISSION BAY BOUNDARY
30
THICKNESS OF BAY MUD IN FEET
---?--?--?--?--?--
PROJECTED THICKNESS OF BAY MUD

Mission Bay

SOURCE: Dames & Moore

FIGURE VI.K.4
THICKNESS OF BAY MUD

sands./1/ The old bay clay may be more than 200 feet thick in the middle of the San Francisco Bay, but along the margins of the Bay this unit may be missing./9/ At Mission Bay, the maximum thickness of the old bay clay is about 110 feet./1/

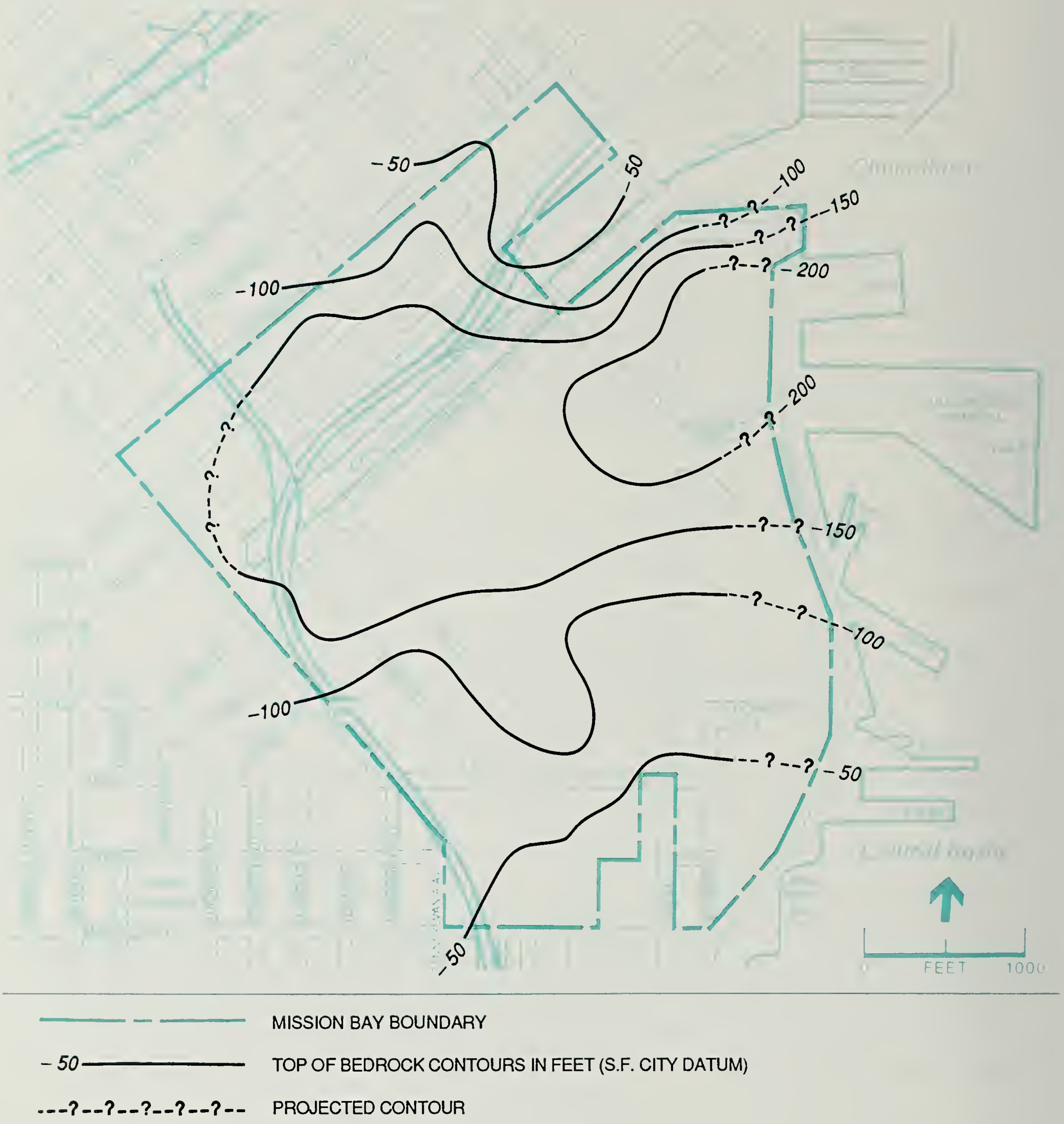
- Franciscan Assemblage: The Franciscan Assemblage, bedrock at Mission Bay, is a widely distributed rock group which contains a variety of rocks formed on the ocean floor and subsequently deformed by large-scale geologic processes. The depth to bedrock is shown in Figure VI.K.5. It varies from 0 to more than 200 feet below San Francisco City datum. At Mission Bay the Franciscan Assemblage is represented by only three major rock types: melange, serpentine and a dirty gray sandstone known as graywacke. Before deposition of the younger sedimentary material on it, the Franciscan bedrock was exposed in a surface with considerable relief and deep weathering./7/ It is, therefore, not a flat solid surface at depth, but a steeply sloping, irregular surface which has been buried.

Geologic Site Development Constraints

Settlement

The most compressible materials occurring on the site are unengineered artificial fill and Bay Mud. These materials are found on most of the site although the exact placement is unknown at this time. Settlement of several feet has occurred since unengineered fill was placed on the site beginning in the last century and settlement will continue, although at a decreasing rate. If no additional load from fills or structures with shallow foundations is placed on the site and the groundwater level does not change, the amount of settlement over the next 30 years is expected to be less than two inches where the Bay Mud is no more than 60 feet thick, less than six inches where the Bay Mud is 70 to 90 feet thick, and up to one foot where the Bay Mud is more than 90 feet thick./2/ Zones of expected settlement under existing conditions are shown in Figure VI.K.6, p. VI.K.9. The amount and pattern of future settlement may be significantly influenced by the presence of existing rubble and trash fill.

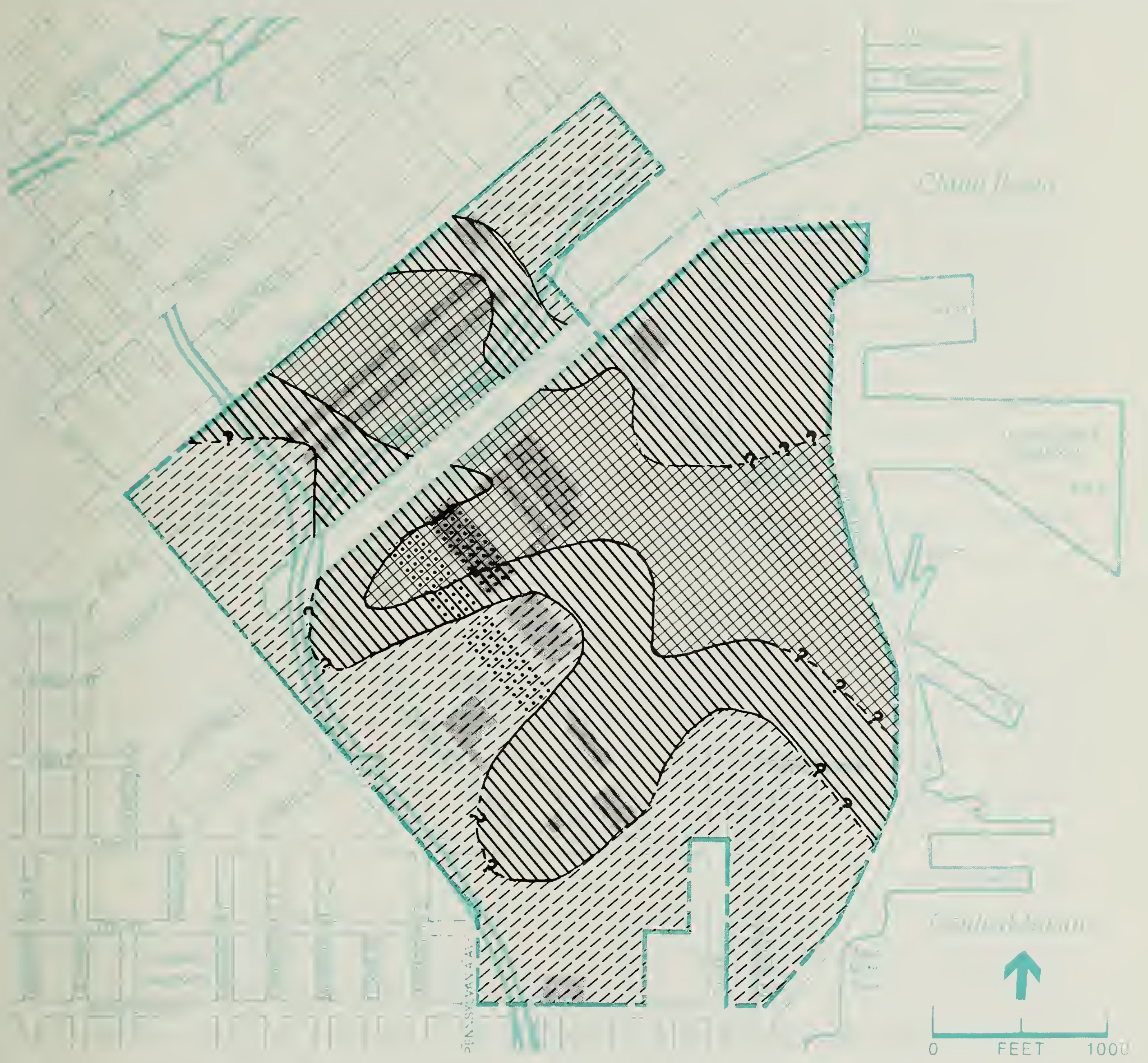
Differential settlement on the site is a likely problem because the fills have variable compressibility, the amount of settlement depends on the thickness of the Bay Mud which varies over the site, and because of structures and piles which have been placed on the site. Warehouses are common on the site and there are numerous places where fill has been placed to raise the ground level to the height of loading docks. These fills, known as dock height fills, are about four feet higher than the existing grade and are additional weight which accelerates the rate of settlement and increases the amount of settlement. Dock height fills are shown in Figure VI.K.6. If the fill has been removed, then the


– 50
50
–100
–150
–200
–100
–200
–150
–100
–100
–50
–50
0
FEET
1000
MISSION BAY BOUNDARY
– 50 TOP OF BEDROCK CONTOURS IN FEET (S.F. CITY DATUM)
---?--?--?--?--?-- PROJECTED CONTOUR

Mission Bay

FIGURE VI.K.5
BEDROCK CONTOURS

SOURCE: Dames & Moore



— — — MISSION BAY BOUNDARY

▨ Less than 2 in. expected settlement of existing fills in next 30 years

▧ 2 in. to 6 in. expected settlement of existing fills in next 30 years

▦ Greater than 6 in. expected settlement of existing fills in next 30 years

▩ Known existing or razed pile-supported structure

⬚ Existing dock height fill

Mission Bay

SOURCE: Dames & Moore

FIGURE VI.K.6
EXPECTED SETTLEMENT IN NEXT 30 YEARS, DOCK HEIGHT FILLS AND PILE-SUPPORTED STRUCTURES

underlying mud has been preconsolidated and will settle less when reloaded than it would if it had not previously been loaded./2/

There are a number of structures on the site that are supported on piles. These include I-280 support structures, some buried storm drains and sewer lines, and some older buildings./11/ At least six pile-supported structures are known to have been removed with the piles left in place: the engine pits near the old roundhouse north of Mariposa Street, a warehouse along the channel in the "Banana Triangle" area, and the four freight sheds south of King Street. There are probably other existing or removed pile-supported structures which are not recorded and are not listed here. Locations of some pile-supported buildings are shown in Figure VI.K.6, p. VI.K.9. The presence of piles creates a "hard" spot which would provide firm support for new structures. However, a "soft" spot, which is difficult to repair, is created if the piles are pulled./2/

In summary, the varying thicknesses of unengineered fills and the highly compressible Bay Mud, the uneven distribution and heterogeneous nature of the fills, and the presence of piles and dock-high fills make settlement a constraint on building and foundation design at the site. Even if structures are pile supported, continuing settlement of the present ground surface will occur.

Ground Failure

If a load, such as a large building, is applied too quickly to the weak Bay Mud, the ground may suddenly fail and cause underlying mud to be squeezed up around the loaded area. This occurs when the mud is loaded so rapidly that the water in the pores between the particles of clay cannot escape quickly enough to allow for compression. Normally failure will occur soon after a load is placed on the mud.

Mud Waves

In areas where the mud is unconfined laterally, like around the bay margins or along a channel, loading can cause the mud to squeeze out into the unconfined areas. This has occurred along the sea wall in San Francisco, at the Bay Bridge Toll Plaza and on the north shore of Hunters Point. In each case, fill placed on the mud has caused mud waves to heave up into adjacent unconfined, unloaded areas./12/

Ground Water Level

- Ground water conditions on the site have been evaluated by Dames and Moore using information from pre-existing and new boring logs. The depth to ground water, as measured from the ground surface in 1982, varied from 3.5 to 9 feet./2/ This is roughly equivalent to mean water level in San Francisco Bay, which is approximately -8.6 feet San Francisco datum./2/ It may be as much as a foot higher in the winter due to infiltration of rain water. In areas where porous fill materials are hydraulically connected to tidal water, the ground water level would rise and fall with tidal action.

Seismic Hazards

Faulting and Earthquakes

No active faults are known to exist within San Francisco. Several active faults are nearby and could affect existing and proposed structures at Mission Bay./13/ The active faults include the San Andreas Fault, about nine miles southwest of the site; the Hayward Fault, about 10 miles northeast of the site; the Seal Cove-San Gregorio Fault, about 20 miles west of the site; and the Calaveras Fault, about 22 miles east of the site. These faults are shown in Figure VI.K.7.

- Both the San Andreas and Hayward Faults have histories of earthquake activity. Studies of seismicity in California and other areas where major tectonic plates meet indicate that comparatively higher levels of seismic activity occur before great earthquakes, but diminish afterward; that is, there is an historic pattern of large and major earthquakes clustering before a great earthquake. After the 1906 earthquake, there was a long quiescence in seismic activity until the mid-1950's. Since that time there has been continuing seismic activity in northern California which "suggests that the San Francisco Bay Area is entering an active stage of the cycle during which major earthquakes can again occur."/14/ A major earthquake of Richter magnitude 7.1, the Loma Prieta earthquake, occurred in October 1989. The epicenter was located about ten miles northeast of Santa Cruz. The earthquake produced strong groundshaking that lasted about 15 seconds and caused extensive damage in the epicentral region in Santa Cruz, Watsonville, Hollister, and Los Gatos. Other areas, as far as 50 miles from the epicenter, were also damaged. Damage in San Francisco and Oakland was widely distributed but was concentrated in relatively small geographical areas.

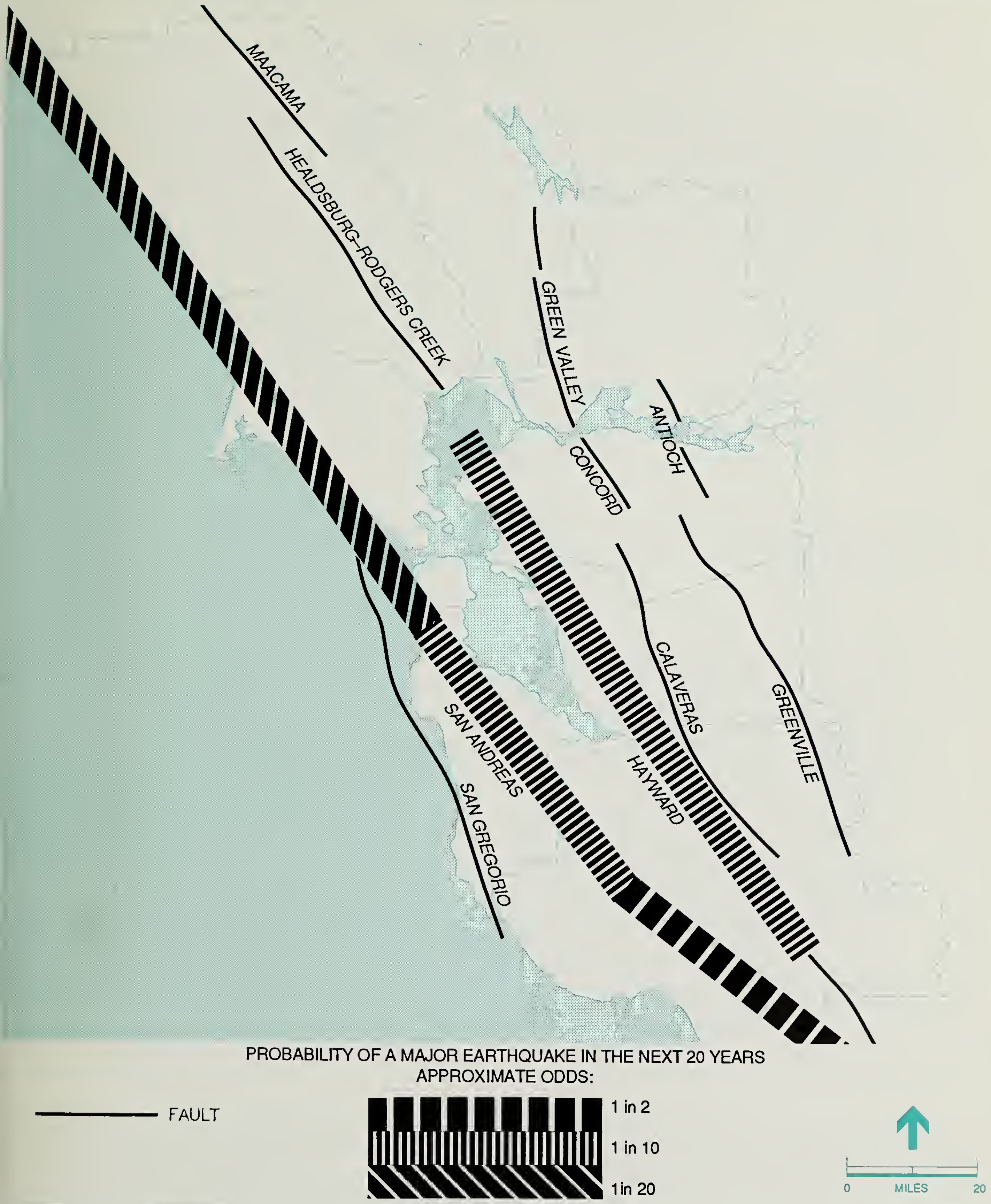
- Damage in San Francisco was generally greatest in areas located in filled land along the northern and eastern edge of the City. Liquefaction-induced ground failure and ground settlement affected some filled areas (particularly the Marina District and the South of Market area), causing severe property damage and fire. Older, unreinforced masonry buildings performed poorly, with partial collapse, foundation failure and parapet damage occurring through a wide area. Some newer buildings (1970's and later) were also damaged; often damage caused temporary closure, but repairs were performed rapidly and use restored.

- One span of the upper deck of the Bay Bridge collapsed. The bridge was temporarily closed (for one month) for repairs. Short-term effects to regional transportation occurred, as drivers found alternative routes between the East Bay and San Francisco (San Mateo and Richmond/Golden Gate Bridges) or used alternative travel modes (BART and ferry). Within San Francisco, major damage to State Route 480 (Embarcadero Freeway) and the I-280 extension caused closure of these roads (repairs are expected to be completed by Caltrans within two to three years), and no long-term transportation impacts are anticipated.

- Data on the Loma Prieta earthquake support the groundshaking intensities projected for the Project Area by ABAG in "On Shaky Ground" for the maximum credible earthquake event (magnitude 8.3 centered near San Francisco). Those projections are used in the impact analysis in this EIR.

- Estimates of the probability of a major earthquake during the next 20 years on the San Andreas Fault or the Hayward Fault range from 2% to 14% near San Francisco; the probability is graphically shown on Figure VI.K.7./14/ An earthquake on the Calaveras Fault could have a shock of up to magnitude 7.3 on the Richter scale./15/ Several small and moderate earthquakes, comparable to the 1957 Daly City earthquake (Richter 5.3), also may be expected to affect the site./16/

Several inactive faults existing within San Francisco are not likely to cause earthquakes and more distant active faults would not create significant hazards in San Francisco./17/


MAACAMA
HEALDSBURG-RODGERS CREEK
GREEN VALLEY
ANTIOCH
CONCORD
CALAVERAS
GREENVILLE
SAN ANDREAS
HAYWARD
SAN GREGORIO
PROBABILITY OF A MAJOR EARTHQUAKE IN THE NEXT 20 YEARS
APPROXIMATE ODDS:
FAULT
1 in 2
1 in 10
1in 20
0
MILES
20

SOURCE: Real, 1984, Probabilistic Long-Term Forecasts of Major Earthquakes in the San Francisco Bay Region

FIGURE VI.K.7
MAJOR BAY AREA FAULTS

> This is one of two localities in the city, the other being a "made" land tract along the former course of Mission Creek, in which destructive effects of great magnitude were conspicuously developed. Only in very close proximity to the fault was greater violence manifested. For blocks the land surface, paved streets, and building plots alike, were thrown into wave forms, trending east and west about parallel to the length of the area. The amplitude and wave-length of these earth billows, and the distances to which they extend, are indefinite and irregular. . . . This slumping movement . . . was greatest near the center, or channel, where the street lines were shifted eastward out of their former straight courses, by amounts varying from 3 to 6 feet. . . .
>
> The greater part of the district was occupied by wooden dwellings and shops, with a small percentage of mediocre brick buildings and a few of substantial construction. The fire swept the area clear. Not even heaps of debris remained to cover the ground, most of the destructive effects being obliterated, along with the structures in which they were developed. . . .

In discussing the area south of China Basin Channel, some of which had been filled by 1906, the Commission report provides the following description:/21/

> The space formerly occupied by Mission Bay has been partly filled to provide building sites, and of course the materials used in filling were deposited in water. The district is occupied in part by structures of great strength, such as railway tracks; in part it is devoid of buildings. Thruout the district, evidence was insufficient and inconclusive. Except near the former outlet of Mission Creek, and in the area further north formerly occupied by the tidal marsh, the destruction produced does not denote intensity higher than Grade C.

In an earthquake of the magnitude of the 1906 earthquake, "virtually every building [in San Francisco] would be expected to have some damage visible to a trained observer"./22/ In addition, groundshaking from large, major or great (Richter magnitude 5.5 – 8.5) earthquakes in the Bay Area could topple unattached interior objects such as stacked items in warehouses, and break and dislodge some windows or exterior panels.

The Commission, summarizing damage to San Francisco which was caused by the 1868 Hayward earthquake, stated that buildings on "made ground" suffered the most damage. In general, effects were similar to those caused by the 1906 earthquake, although less well documented. No tidal wave (tsunami) accompanied the earthquake, but a seiche developed in Laguna Honda, a natural water body located about 2.5 miles west of Valencia and Market Streets./21/

Ground Failure/23/

- Except for the northern corner of the Project Area near Third and Townsend Streets and a small area in the southwest corner where bedrock is near the surface, the Project Area has potential hazards of subsidence, liquefaction and lateral spreading./19/ Portions of

- the Project Area are particularly susceptible to liquefaction because they experienced ground failure in the 1906 earthquake./21/ The Project Area, as a whole, has a high potential for ground failure because of local geology (sand lenses and layers prevalent in Bay and alluvial [river] deposits, and artificial fill) and the presence of shallow groundwater./23a/.

- In 1906, liquefaction and rapid subsidence caused buildings to settle and crack, and water mains, pipes and underground utilities to break in areas along the waterfront that were constructed on fill. Local streets could buckle or crack from lateral spreading that might accompany liquefaction or rapid subsidence. Buildings that would likely receive the greatest damage from ground failure include older structures with poor foundations.

Large modern structures generally are founded on pilings driven into more solid materials at depth or on thick concrete slabs that "float" on a layer of engineered fill or on layers of soil beneath those most susceptible to failure. Both of these foundation types are engineered to support the structure in the event of seismic ground failure.

Tsunami and Seiches

Tsunami are sea waves produced by a large-scale, sudden disturbance on the ocean floor. Submarine earthquakes are the most common cause, but tsunami also result from underwater landslides, subsidence or volcanic eruption. The waves are fast-moving and of low amplitude in the open ocean, although they may pile up suddenly as they enter shallow coastal waters./24/

The 1906 earthquake apparently did not generate tsunami./21/ Predictions of tsunami runup for the San Francisco Bay Area are given in several publications but there remains considerable uncertainty over the extent of tsunami runup which would occur in the Project Area./22,25,26/

A seiche (pronounced saysh) is a rare oscillation of the surface water in an enclosed basin, such as a bay or lake, caused chiefly by local changes in atmospheric pressure aided by winds or by an earthquake. The most likely generating mechanism for a seiche in San Francisco Bay is motion along one of the major faults in the Bay Area. The seiche generated by the 1906 earthquake caused several oscillations of one to two inches. The period of recurrence was 40 to 45 minutes./21/ Based on this historic occurrence, a major earthquake is not expected to cause a destructive seiche in the Bay.

CITY AND COUNTY SEISMIC SAFETY MEASURES AND POLICIES

The Community Safety Element of the Master Plan contains four objectives that highlight seismic safety and emergency preparedness directives.

- Objective 1, "Reduce hazards to life safety, minimize property damage and economic dislocations resulting from future earthquakes," would require geologic or soil engineering site investigations and modification of land uses and/or structures throughout the Project Area consistent with acceptable risk levels.

- Objective 2, "Preserve, consistent with life safety considerations, the architectural character of buildings and structures important to the unique visual image of San Francisco," encourages renovation and structural reinforcement of significant structures. In the Project Area, this objective would apply to the brick firehouse located near the intersection of Third, Fourth, and Mission Rock Streets and the Third and Fourth Street Bridges./27/

- Objective 3, "Ensure the protection of life and property from the effects of fire or natural disaster through adequate emergency operations preparation." To respond to this objective, the Mayor's Office of Emergency Services (OES) promotes emergency response planning for individual buildings and areas, coordinating the involved agencies. This objective is met by planning and coordination among City agencies. It can be more effective if Objective 1 is carefully implemented. For the Project Area, locations of access routes are of particular concern for emergency planning.

- Objective 4, "Assure the sound and rational reconstruction of San Francisco following a major disaster," applies to the entire City. The behavior of structures and geologic materials in a major earthquake can provide valuable insight for improving seismic design standards. Design and code changes should be applied to rebuilt structures and necessary changes in land uses should be made based on the performance of structures in a major earthquake.

Office of Emergency Services

The Mayor's Office of Emergency Services (OES) coordinates planning to provide an effective integrated response to emergencies of all kinds. It deals with the emergency management system, operational and organizational policies, procedures and emergency response for earthquakes and other disasters (e.g., flood/tidal wave, fallen aircraft, and chemical accidents). It promotes and reviews emergency response planning for individual buildings and areas. The OES guides the development and updating of the city's Basic Emergency Operations Plan, which generally defines the emergency organization of the City and County of San Francisco and assigns general responsibilities to the departments and agencies that comprise the emergency organization. It also provides the organizational procedures and actions to be followed by hospitals, all City departments and agencies, including the Police and Fire Departments, as well as state and federal actions, during the first few days of a disaster. Lifeline and emergency services such as utilities, phones, the American Red Cross, Salvation Army and volunteer organizations concerned with minimizing the effects of a disaster are coordinated by OES. The San Francisco Earthquake Response Plan supports the Basic Emergency Operations Plan./28/

In the event of a disaster, the Mayor of San Francisco would control and direct the emergency services of San Francisco as the Commander of Emergency Services. Central control would be exercised from the primary Emergency Operating Center at 1003 Turk Street. All city employees, as members of the Emergency Services organization, would be under the direction of the Commander of Emergency Services. The OES would serve as a coordinating link in the lines of communications and authority between the City and County of San Francisco and the California State Office of Emergency Services and the Federal Emergency Management Agency./28/

Under the City's Emergency Operations Plan, prepared under the guidance of the OES, San Francisco is divided into ten Emergency Operations Districts, generally corresponding to the city's ten Fire Battalion Districts. The Mission Bay Project Area is completely within District 3. The primary emergency operations headquarters for District 3 is located in Fire Station 8 at 36 Bluxome Street. The primary Mass Care Facility is located at Potrero Hill Middle School, 55 Deharo at 18th Street./29/ The primary Casualty Care facilities are located at San Francisco City Clinic, 250 4th Street and at South of Market Health Center, 551 Minna. The primary Multi-Purpose Staging Area is located at the Hall of Justice, Bryant Street, as is the emergency (helicopter) personnel pickup & landing point./30/ These facilities are subject to earthquake damage, but they are generally above average in structural integrity when compared to other structures that could be used to house emergency services./28/ The Jackson Playground, at 17th Street and Carolina Avenue, could be used as a long-term, temporary housing site.

Seismic Investigation and Hazard Survey Advisory Committee (SIHSAC)

The San Francisco Building Code, Section 204.1B, establishes the Seismic Investigation and Hazard Survey Advisory Committee (SIHSAC) which consists of engineers, geologists and seismologists to keep the Board of Examiners and the Board of Supervisors apprised of updated seismic hazard information and to review and recommend engineering and planning criteria necessary to reduce seismic hazards.

The concerns of SIHSAC and city agencies include the issues of seismically induced soil failure such as liquefaction, settlement and lateral spreading; surface rupture, ground shaking, tsunami, and seiche; seismic design criteria for structures, including siting, foundation type, construction quality assurance and control; infrastructure facilities including electrical transmission, communication, fuel (both gas and liquid) storage and transmission, and wastewater; and preparedness planning.

The Citizen's Advisory Committee serves under the auspices of SIHSAC specifically to study the issue of seismic structural upgrade of unreinforced masonry buildings. They will recommend effective means to upgrade such structures to prevent their collapse in an earthquake. Most unreinforced masonry buildings are located in the Tenderloin, Chinatown, and the Bush Street Corridor; one such building, vacant firehouse 30, is in the Project Area.

IMPACT

This section describes topographic changes and provides estimates of the amount of earth material to be moved in the Project Area by dredging, grading, and excavation for foundations. It also contains a discussion of geotechnical characteristics of the soil which may constrain development and land use, including its susceptibility to seismic hazards. Impacts are discussed for build-out of the Alternatives when full effects would be evident.

TOPOGRAPHY AND GRADING

Permanent changes in topographic relief would be associated mainly with the construction of low berms to provide sufficient depth of soil suitable for planting and the development of wetlands (as included in Alternative B). Under each Alternative, the Project Area would remain predominantly flat as it is now. Final elevations would be at or near existing elevations. Temporary changes in topography would occur during excavations for construction and would result if surcharges were used on the site.

The volume of material estimated to be excavated by dredging and for building foundations for each Alternative is summarized in Table VI.K.1. The volumes presented in Table VI.K.1 are estimates rounded to two significant figures. Dredging volumes have been separated into wet dredging, which would occur within China Basin Channel, and dry dredging, which would be initiated on dry land but would extend to sufficient depths to allow flooding of the excavation. Dry dredging would create new wetlands in Alternative B. Directly calculated volumes of soil have been increased by 35% as a contingency factor to provide a conservative analysis. The following assumptions have been made for purposes of estimating the maximum amount of material to be excavated at the site:/31/

- All structures with fewer than six stories (including basement) that would be completely underlain by soil where anticipated areal settlement is less than six inches would be constructed on floating or compensating foundations. One foot of soil would be excavated for each story of building height (because one foot of soil is approximately equal in weight to one story)./32,33/

- Structures six or more stories in height would be pile-supported and a total of one foot of soil would be excavated for their foundations./32/

TABLE VI.K.1: AMOUNT OF MATERIAL EXCAVATED AND/OR DREDGED, BY ALTERNATIVE (Thousands of Cubic Yards)

	Alternative A 1986-2020	Alternative B 1986-2020	Alternative N 1986-2020
Wet Dredging/a/	135	0	0
Dry Dredging/b/			
For T-Wall Construction	85		
China Basin	0	120	0
4th and 6th Streets	0	160	0
South of Pier 54	0	100	0
Foundation Excavation	2,400	3,420	1,910
TOTAL	2,620	3,800	1,910
Additional Dry Dredging/c/			
China Basin	--	40	--
4th and 6th Streets	--	50	--
South of Pier 54	--	25	--
TOTAL	--	115	--

/a/ Dredging of the channel would be done after construction of a T-wall so that small boats could use the channel at low tide. Construction of the T-wall would require excavation of up to 85,000 cubic yards. Initial dredging of 45,000 cubic yards with an equal amount dredged approximately every ten years is assumed for these estimates.

/b/ For construction of T-wall and creation of wetland areas. If the water table is too shallow, it may be necessary to finish dredging in the wetland areas using wet-dredging techniques.

/c/ This assumes that if soil exposed by initial dredging were unsuitable as substrate for wetland vegetation, two more feet would be dredged.

SOURCE: Environmental Science Associates, Inc. and KCA Engineers.

- All structures located where anticipated areal settlement is greater than six inches would be pile-supported and one foot of soil would be excavated, regardless of building height./32,33/

- The footprint of each office building, S/LI/RD structure, and hotel would occupy 80% of its parcel; and residential buildings would have footprints occupying 75% of their parcels./34/ There would be 100% coverage of some parcels if parking were included, but the building footprints requiring foundations would not be likely to cover the entire parcel.

These assumptions regarding excavation and foundation type are based on general guidelines and requirements for ensuring structural integrity of buildings under earthquake groundshaking hazard estimates at the site, as well as general soil and groundwater constraints (see discussion beginning on p. VI.K.7).

Surcharging

Surcharging, the placement of added fill on site to speed up settlement, is done to preconsolidate highly compressible soils like those found at Mission Bay. When a load is placed on soil, spaces between grains of soil are squeezed and the soil compresses. Surcharging soil on a building site is allowed to remain until a significant amount of consolidation has occurred. Then when the surcharged soil is removed to allow placement of the building, much of the settlement will have already occurred under the weight of the surcharge. No specific plans for the use of surcharges have been proposed although this is a common practice for construction in Baylands. If surcharging were used at Mission Bay, it would involve the placement of from two to five feet of soil on and around the building site for at least six months and preferably one to two years. The placement of drainage wicks in the soil would allow for rapid removal of water being squeezed out of the soil and would speed consolidation. If wicks were not used, surcharging would occur too slowly to be useful in areas where Bay Mud is greater than 10 to 20 feet thick./1/ This includes most of the Project Area (see Figure VI.K.4, p. VI.K.6).

Differential settlement is expected at the boundary of the surcharge area. In order to prevent these edge effects, the surcharge as a general rule would extend beyond the footprint of the building for a distance equal to approximately twice the depth to the bottom of the Bay Mud or as determined necessary by further studies. At the beginning of construction for a surcharged site, the surcharge would be moved to another location, where it would continue to serve as a consolidating agent. To maintain the original elevation of the ground surface, it would be necessary to add clean fill (composed of engineered soil with no trash or construction debris) to the surcharged area. Calculations done by Dames and Moore for an area underlain by 90 feet of Bay Mud and 15 feet of fill indicate that 2.5 feet of surcharge (with wicks) in place for one year could result in four feet of settlement./33/ Such an area could require almost 6,500 cubic yards of soil per acre to raise the surface to the elevation it had when surcharging began.

While surcharging can reduce hazards of settlement where it is used, it can increase the hazard of lateral spreading of unconsolidated fill and mud in adjacent areas. In addition, surcharging near the bayshore can induce slowly moving mud waves offshore. Mud waves within China Basin Channel and off the Bay shore would reduce water depth and could impede commercial and recreational navigation unless removed by dredging. Additionally, a mud wave could effect a change in benthic organisms. Mud waves are discussed on p. VI.K.30.

Disposal of Excavated Material

Disposal of excavated materials and dredge spoils would depend on their degree of contamination with hazardous materials. Based on preliminary assessments by KCA Engineers and CH_2M Hill (see p. VI.L.10), it is likely that wet dredge spoils from the channel would be contaminated with heavy metals and organics and would require special handling and disposal./35,36/ It is possible, and in some locations likely, that dry dredge spoils and foundation excavation materials would also require similar treatment. The likely nature and disposition of hazardous materials are discussed later in this section.

Clean dry-dredge spoils could be used to construct berms for planting, temporarily used as surcharge material, or hauled off-site in trucks to a location where clean fill would be accepted. The locations of disposal sites and routing have not been determined.

Alternative A

Total amounts excavated for foundations could reach 2,400,000 cubic yards from the start of construction to build-out (see Table VI.K.1, p. VI.K.20). It would be tested for hazardous materials pursuant to local and state requirements and disposed of as appropriate (see Regulatory Framework in VI.N. Hazardous Wastes, p. VI.N.17).

Initial Phase of Development. The initial phase would include construction of a T-wall, a vertical concrete retaining wall, along the north side of the channel and subsequent dredging of the channel. Dry dredging and excavation for the T-wall could result in the movement of up to 85,000 cubic yards of soil. About 45,000 cubic yards of material would be wet dredged (see Table VI.K.1, p. VI.K.20) using a combination of equipment operating from the banks of the channel and equipment on a boat or barge./37/ The channel, when dredged, would enable boats to move more easily at low tides.

Alternative B

Total amounts excavated for foundations could reach 3,420,000 cubic yards from the start of construction to build-out. Up to 380,000 cubic yards of material would be dredged for creation of wetlands at China Basin Channel, China Basin near Pier 48 and near Pier 54. This total dredging includes 160,000 cubic yards at the China Basin Channel wetlands site between Fourth and Sixth Streets; possible additional 50,000 cubic yards may be dredged if the soils are found to be unsuitable for wetlands vegetation, either because the soil has the wrong physical characteristics or is contaminated. The dredging total also includes 120,000 cubic yards at the China Basin site near Pier 48 and 100,000 cubic yards at the site near Pier 54; additionally 65,000 cubic yards (40,000 cubic yards at China Basin and 25,000 cubic yards south of Pier 54) may be dredged at those sites if the soil is found to be unsuitable for wetland vegetation. The additional soil removed because of unsuitability would require an equal volume of suitable material (clean fill) imported as its replacement. Creation of planting berms and islands in wetlands could require up to 65,000 cubic yards of fill. If the dredged or excavated material were suitable, some of it could be used to construct the berms and islands. Material not used on-site would be disposed as for Alternative A.

Initial Phase of Development. The initial phase would require excavation of at least 26,000 cubic yards of soil for foundations.

Alternative N

Total amounts excavated for foundations could reach 1,910,000 cubic yards from the start of construction to build-out. It would be tested and disposed of as for Alternative A.

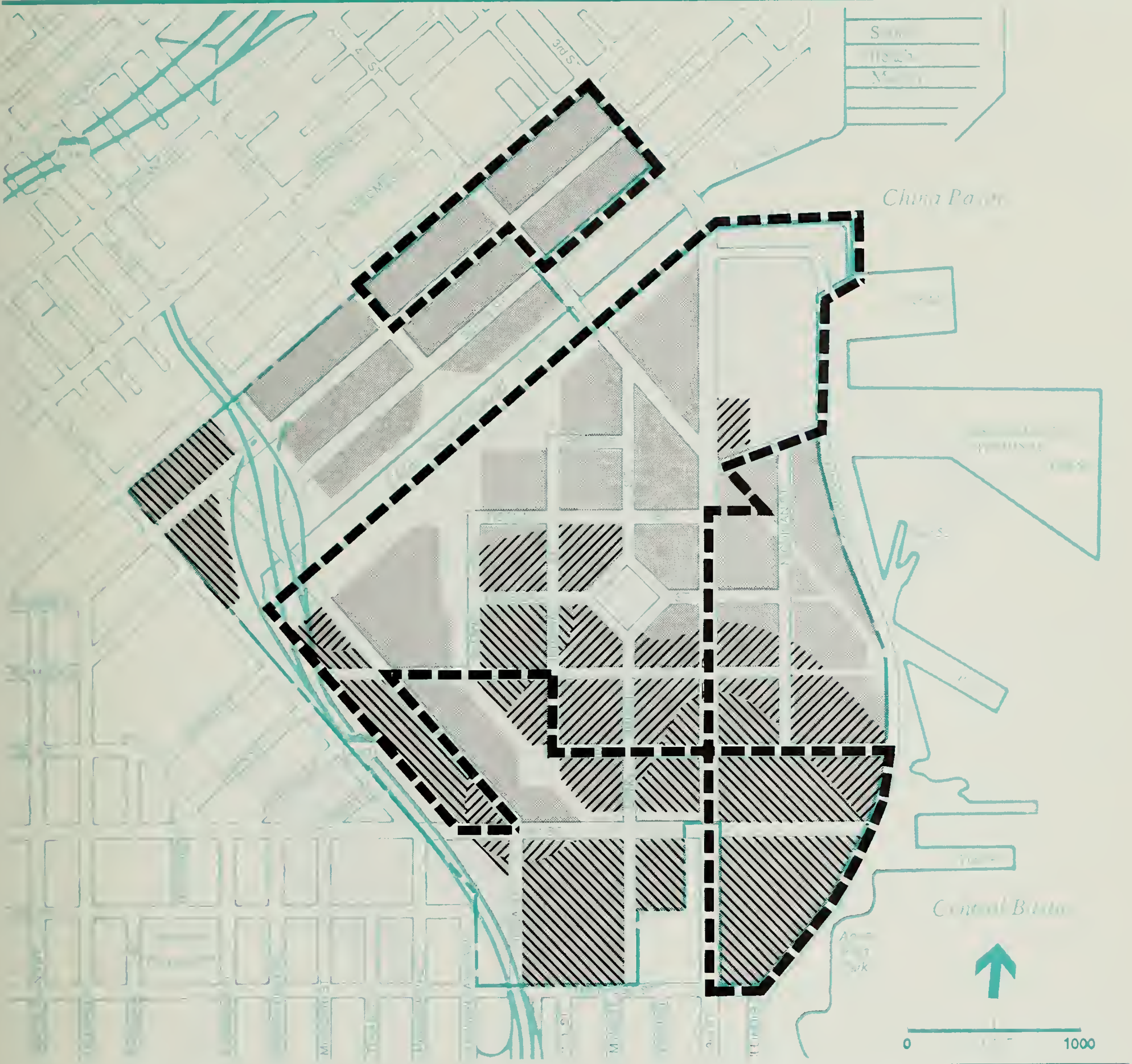
GEOLOGIC SITE DEVELOPMENT CONSTRAINTS

Areal Settlement and Foundation Types

Selection of foundation types for each building would depend primarily on the building height and amount of settlement expected at the building site. Detailed geotechnical engineering studies of each building site would be required before foundations could be designed. The following information provides general guidelines based on information presently available about the soil in the Project Area and building types proposed. Figures VI.K.8, VI.K.9, and VI.K.10 illustrate areas where various foundation types could be used, based on the combination of expected settlement and building heights. Table XIV.I.1 in Appendix I, p. XIV.I.1, shows acreage devoted to building uses in each of the three settlement zones. Table VI.K.2, p. VI.K.28, lists some foundation types, including shallow foundations and piles, and summarizes some of their basic characteristics.

Piles would be used to support structures built in areas where expected settlement is greater than six inches or where buildings would be greater than five stories in height (including basement), regardless of the amount of settlement of underlying soil expected in the area./38/ Pile-supported structures would not settle appreciably, but the surrounding roads, sidewalks, and open space would continue to settle at the predicted rates. This would cause sidewalks and driveways to sink away from buildings. The changing relative elevations of the building and the surrounding land can break utility connections./39/ Because most settlement is expected to occur within 30 years after construction, damage to utility lines would be most likely during that time frame. This effect would be most severe where total settlement is expected to exceed six inches and less severe where settlement would be less. In general, settlement damage can be partially or completely mitigated through use of ductile materials and special joints on utility lines.

Foundations for structures of one to two stories could be conventional spread footings or stiffened slabs, without basements, in areas where limited differential settlement (variations in amount of vertical settlement over short distances) is expected and anticipated areal settlement is less than two inches. Stiffened slabs can be used to span soft areas which are small relative to the building size, if the load-bearing perimeter of the slab is well supported. Buildings on these foundation types settle faster than surrounding soil because the load has been increased by the weight of the structure.



MISSION BAY BOUNDARY

AREA BUILT BY YEAR 2000

▒ Area where piles required

Piles could be required anywhere in the Project Area, but if differential settlement and other soils and groundwater conditions are favorable, as determined by site-specific geotechnical investigations, the following may substitute for pile foundations:

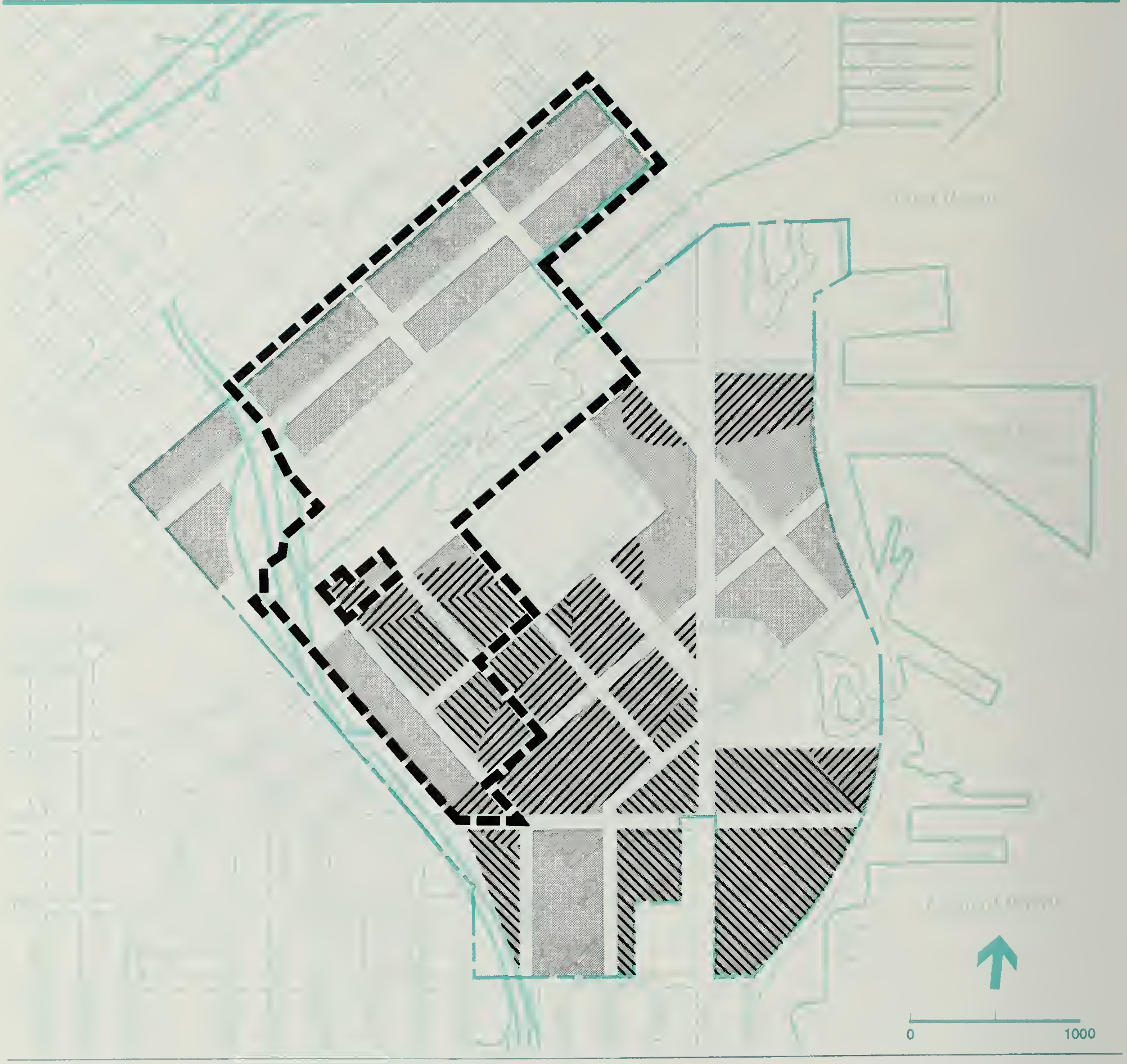
▨ Compensating foundations may be possible (1-5 stories)

▧ Spread or slab (1-2 stories) or compensating foundations (1-5 stories) may be possible

Mission Bay

SOURCE: Environmental Science Associates, Inc. and Dames & Moore

FIGURE VI.K.8
ALTERNATIVE A
FOUNDATION TYPES



MISSION BAY BOUNDARY

AREA BUILT BY YEAR 2000

▨ Area where piles required

Piles could be required anywhere in the Project Area, but if differential settlement and other soils and groundwater conditions are favorable, as determined by site-specific geotechnical investigations, the following may substitute for pile foundations:

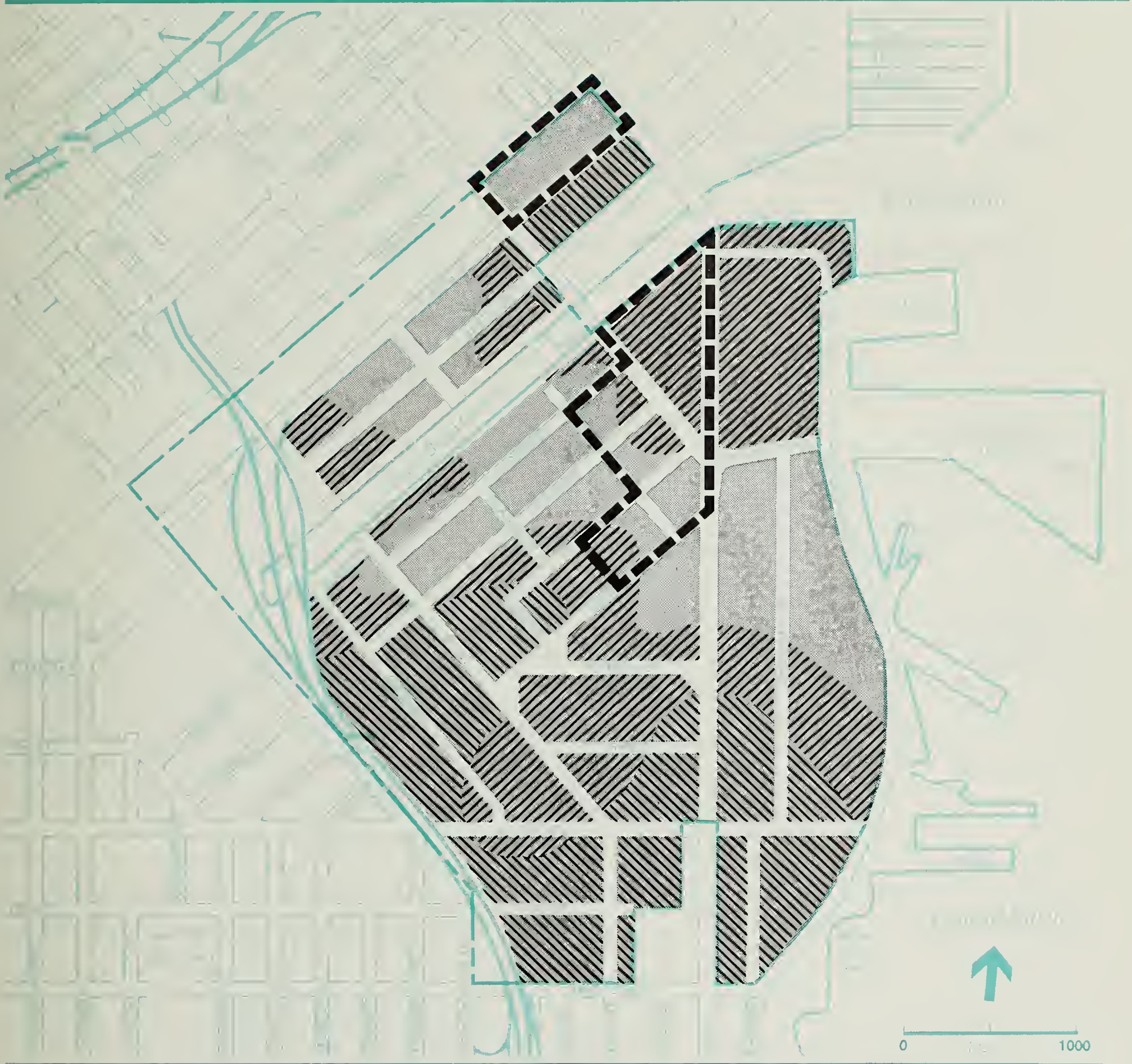
▨ Compensating foundations may be possible (1-5 stories)

▨ Spread or slab (1-2 stories) or compensating foundations (1-5 stories) may be possible

Mission Bay

SOURCE: Environmental Science Associates, Inc. and Dames & Moore

FIGURE VI.K.9
ALTERNATIVE B
FOUNDATION TYPES



— — — MISSION BAY BOUNDARY ▬ ▬ ▬ AREA BUILT BY YEAR 2000

▒ Area where piles required

Piles could be required anywhere in the Project Area, but if differential settlement and other soils and groundwater conditions are favorable, as determined by site-specific geotechnical investigations, the following may substitute for pile foundations:

▨ Compensating foundations may be possible (1-5 stories)

▧ Spread or slab (1-2 stories) or compensating foundations (1-5 stories) may be possible

Mission Bay

SOURCE: Environmental Science Associates, Inc.
and Dames & Moore

FIGURE VI.K.10
ALTERNATIVE N
FOUNDATION TYPES

TABLE VI.K.2: FOUNDATION TYPES WHICH MAY BE USED AT MISSION BAY/a/

Foundation Type	Floors	Basement	Potential Land Use	Comments on Foundation Type
Spread	1-2	No	S/LI/RD LDR CF	Can be used in areas with little areal settlement and negligible differential settlement. Easily damaged by liquefaction.
Stiffened slab	1-2	No	S/LI/RD LDR CF	Sustains some areal settlement, negligible differential settlement. Sensitive to liquefaction effects. Stiffened slabs resist effects of differential settlement over distances less than the slab size.
Compensating (aka raft or floating)	1-5	Yes	S/LI/RD LDR,MDR CF	Can be used in areas with some areal settlement and negligible differential settlement. Settles at same rate as surrounding soil but is sensitive to differential settlement. Sensitive to liquefaction effects. Taller buildings may be sensitive to amplification of seismic waves by underlying soft sediment.
Friction Pile	Any	Yes	Any	Used to transfer load of structure and downdrag to stiff soil beneath Bay Mud. Requires at least 50 feet to 70 feet of stiff soil. Soil will settle away from structure, causing problems with connection to sidewalks, driveways, utilities. Resistant to liquefaction if piles extend below affected substrate layers. Taller buildings may be sensitive to amplification of seismic waves by underlying soft sediments as piles move with the soil.

(continued)

TABLE VI.K.2: FOUNDATION TYPES WHICH MAY BE USED AT MISSION BAY/a/ (continued)

Foundation Type	Floors	Basement	Potential Land Use	Comments on Foundation Type
End-Bearing Piles	Any	Yes	Any	Transfers load of structure and downdrag to bedrock. Due to variable nature and surface of bedrock, may require considerable penetration into bedrock. Soil settles away from structure causing problems with connection to sidewalks, driveways, utilities. Resistant to liquefaction because piles are supported on firm bedrock.

/a/ Detailed site investigations would be required prior to design. This is a list of some common foundation types and is not exhaustive. Other foundation types are possible.

SOURCE: Environmental Science Associates, Inc., using information provided in Dames and Moore, Preliminary Report, Geotechnical Consultation, April 15, 1982

Connections to utilities, sidewalks, and driveways are therefore vulnerable to breakage. Most settlement would occur within 30 years after construction and the greatest potential for property damage would be during that period.

Compensating foundations for structures of up to five stories could be used in areas with limited differential settlement and where areal settlement is less than six inches. To build this type of foundation, also known as floating or raft foundation, soil equal in weight to the completed building is removed and the building is constructed in the excavated area. The building settles at the same rate as the surrounding soil because the load on the soil is substantially unchanged. For purposes of planning, one foot of soil is roughly equivalent in weight to one floor of building height.

Differential Settlement

Total areal settlement as discussed above can cause problems at points where structures and surrounding areas join; however, differential settlement can be a much more serious impediment to construction. Differential settlement occurs when nearby areas have different characteristics (such as thickness of underlying Bay Mud) which cause significantly different amounts of settlement and rates of settlement. The stress placed on structures by uneven ground movement as a result of differential settlement can damage the structures. The entire central and eastern parts of the site, where expected settlement is greater than two inches (see Figure VI.K.6, p. VI.K.9), may be subject to substantial differential settlement. The most severe effects of differential settlement would be expected immediately south of the channel where pile-supported structures have stood or where dock-height fills (fill emplaced to raise ground level to height of loading docks at warehouses) are found and where the zones of expected settlement are narrow (see Figure VI.K.6, p. VI.K.9). It is possible that a new building could use existing piles for support or employ the dock-height fills as surcharge if the footprint of the new building were entirely supported by the existing piles or the dock-height fills.

Mud Waves

- Heavy loads placed on natural or artificial fill materials near the southern edge of the channel or along the bayshore could (but would not necessarily) cause mud to squeeze out along the unsupported face at the water's edge, forming mud waves. The 200-foot distance from the channel or bay shore should be regarded as conservative: fill could be placed closer to the shore and not cause mud waves to form. A structure that is pile-supported would not cause mud waves. Mud waves would reduce water depth and might hinder marine navigation. They may also affect benthic ecology.

Groundwater Levels

Lowering the water level for any reason, such as dewatering during construction or to keep basements dry after construction, would accelerate settlement, including differential settlement. Dewatering could cause settlement effects on existing nearby structures as well as for buildings on the site. This could limit the use of compensating foundations to those areas where the groundwater table is several feet below ground surface, where major dewatering would not be necessary. There are no areas where groundwater is deep enough for a full basement to be used without dewatering. Those conditions apply equally to all Alternatives during the entire development period.

Effects of groundwater chemistry and water quality are discussed in VI.L. Hydrology and Water Quality, p. VI.L.19.

Corrosive Soils

Soils at Mission Bay, which are heterogeneous and include construction debris and trash, may include local areas with high sulfate concentrations. Detailed site-specific soil sampling would be necessary to determine sulfate levels in site soils. Soils rich in sulfate can be corrosive to concrete pipes or foundations. High chloride content, which would be expected at a site with brackish groundwater, can promote corrosion of metal pipes and metal reinforcements in concrete structures. These conditions apply throughout the Project Area to all three Alternatives during the entire development period.

Alternative A

As shown in Figure VI.K.8, p. VI.K.25, approximately 94.5 acres of land would have been developed at build-out under conditions calling for the use of pile-supported structures. This would include offices (26.8 acres), HDR (7.0 acres), MHDR (20.8 acres), and the hotel (3.5 acres) more than five stories tall. Pile-support would be expected for S/LI/RD (1.2 acres), Port-Related/M-2 (6.5 acres), MDR (23.8 acres), LDR (4.2 acres), and community facilities (0.7 acres) in areas where expected settlement is greater than six inches. About 107.5 acres would be developed under conditions that may require pile-support for foundations. This would include S/LI/RD (49 acres), retail (0.4 acre), LDR (2.2 acres), MDR (39 acres), community facilities (1.7 acres), and a CalTrain station (13.7 acres). The existing pump station is already pile-supported (1.5 acres). About 123 acres would be used for open space, streets and infrastructure or left vacant.

- Construction of housing along the Channel, S/LI/RD south of 15th Street, and LDR built along the waterfront just north of 15th Street has the potential to cause mud waves if shallow foundations were used. If buildings were properly designed and constructed, however, building activity would not result in mud wave formation.

- Initial Phase of Development. All buildings developed in the initial phase would require pile supports because they are located in areas where more than six inches of settlement is expected or are taller than five stories. If buildings constructed during the initial phase were pile-supported, they would not cause lateral spreading of soils that could result in effects on adjacent parcels or in mud waves. The MDR along the channel (if not pile-supported), S/LI/RD structures south of 15th Street, and LDR north of 15th Street are near unsupported surfaces and could cause mud waves if structures overload the bearing capacity of the soil. If proper engineering design and appropriate construction techniques are used, however, mud waves should not occur.

Alternative B

At full build-out in the year 2020, pile-supported structures would be constructed on 70.2 acres of the Project Area. This would include buildings for offices (5.9 acres), retail (0.2 acres), housing (MHDR, 41.1 acres; MDR, 13.9 acres; LDR, 6.5 acres), and community facilities (2.6 acres).

About 96.5 acres would be developed and may require pile-supported foundations. This would include S/LI/RD (6.0 acres), retail (2.0 acres), LDR (12.4 acres), MDR (59.3 acres), community facilities (3.0 acres), and a CalTrain commute station (12.3 acres). The existing pump station is already pile-supported (1.5 acres). About 158.3 acres would be used for open space, streets and infrastructure, or left vacant. Housing units along the waterfront south of Pier 64 could induce mud waves if spread or slab foundations were used.

Initial Phase of Development. The initial phase of development would occur where differential settlement may be severe. The office structure would have to be pile supported. The housing and retail space may require piles.

Alternative N

A total of 57.2 acres (offices, 5.2 acres; M-2 Industrial, 31.2 acres; Port-Related/M-2, 20.0 acres; and community facilities, 0.8 acres) would require piles. About 182.8 acres may require supported foundations, including retail (1.7 acres), M-2 Industrial (98 acres), Port-Related/M-2 (45.5 acres), and the CalTrain station (36.1 acres). The existing pump station is already pile-supported (1.5 acres). About 85.0 acres would be open space, streets and infrastructure or left vacant.

The M-2 Industrial buildings along the channel and Port-Related/M-2 on the waterfront could induce mud waves if constructed on slab or spread foundations.

CONSTRUCTION HAZARDS

The water table at the site ranges from three feet to nine feet deep. If it is necessary to excavate below the water table during construction, dewatering would be required. Dewatering would accelerate the rate of settling in areas near excavations causing increased differential settlement of adjacent structures. The side walls of the excavation would require reinforcement in order to avoid collapse or deformation of the excavated area. If such collapse were to occur, it would pose a hazard to workers at the construction site and to nearby passersby on sidewalks and streets. In addition, it could damage buildings and infrastructure in adjacent areas. These conditions are typical of construction in many areas of San Francisco and would apply to all Alternatives during all phases of development.

Excavation and pile-driving in the Project Area could experience delays because of the variable nature of fills that are likely to be found. For example, the portion of the Project Area around the end of China Basin Channel was used as a City dump; other parts north of the channel were used for the disposal of debris after the 1906 earthquake and fire. Therefore, it is likely that a wide variety of artificial materials would be encountered which could make subsurface construction activities more difficult than usual in natural bay muds.

SEISMIC HAZARDS

Groundshaking

The entire site would be subject to violent or very strong groundshaking during maximum earthquakes expected on the major faults in the Bay Area./19/ The faults analyzed include the San Andreas (8.4 magnitude), Hayward (6.9 magnitude), San Gregorio (7.1 magnitude), and Calaveras (7.3 magnitude). Groundshaking would be similar to that in South of Market and portions of downtown. The extent of building damage would depend on the type of groundshaking generated by the earthquake as well as the kind of building construction. Soft sediments such as Bay Mud are likely to amplify seismic waves when groundshaking occurs at lower frequencies (long waves) that resonate within the soil column. In those cases, buildings at Mission Bay that vibrate at the same low frequency as the sediments and that are underlain by unengineered fill and Bay Mud would shake more than those supported on bedrock. Studies of the recent earthquake in Mexico City (built on lake muds), for example, indicated that buildings in the height range of 5 to 15 stories had resonant frequencies that matched the longer earthquake waves amplified by those soft soils; therefore, buildings in those height ranges were most vulnerable to damage./40/ In the Project Area, the buildings most at risk to damage from this type of groundshaking also would be five-story or taller buildings. Building form and mass also affect response to shaking. In general, tall narrow buildings would be more vulnerable to earthquake shaking damage than would lower, broadly massed buildings.

In contrast, earthquakes that generate high frequency (short wave) motions may not resonate in the deep muds, sands and fill; therefore, under such earthquake motion, buildings at Mission Bay may be at equal but not greater vulnerability than those on bedrock or on muds, sands, and fill which lie in shallow layers over bedrock.

Ground Failure

Ground failure resulting from seismic shaking, as well as damage caused directly by the shaking itself, would also affect infrastructural elements in the Project Area and in the vicinity including highways, bridges, utilities, and piers./41,42/ Some roads in the susceptible areas may become impassable because of cracking from subsidence and liquefaction. In the event of an 8.3 Richter magnitude earthquake on the San Andreas Fault or a magnitude 7 earthquake on the Hayward Fault, the San Francisco Bay Bridge is projected to be closed for at least three days because of subsidence and liquefaction on the east approach, and possible failure of the elevated structures in San Francisco./41,42/ The Golden Gate Bridge would be closed because of impassable approaches. The downtown freeway system (James Lick Freeway and Highway 101) would be closed for at least three days because of ground failure./41/ The elevated portion of I-280 is likely to be significantly damaged during a strong earthquake, but it should not experience general collapse./43/ Traffic on I-280 would be limited to one lane for at least 24 hours due to landslides at Potrero Hill./42/ The CalTrain commute station and commute line would be closed, as would MUNI. BART would be out of service for a minimum of 72 hours./42/ These closures would result from a combination of ground failure, power outages and debris-blocked tracks and streets./22,41/ Port facilities adjacent to the site are likely to remain usable for emergency operations, but transport of people and supplies from the port to various locations in the city would be impaired by closed streets./44/ Other emergency services communication, such as radio contact, is expected to operate at higher capacities.

Telephone communication systems within San Francisco would be at or under 25% of full system effectiveness for at least three days after a major earthquake, and a total restoration of service would take considerably longer. Potrero and Hunters Point power plants would be shut down for an indefinite period./44/ Other emergency service communications, such as radio contact, are expected to operate at higher capacities.

Because of the potential collapse of elevated roads, blockage of streets by building debris, and damage to bridges in the event of a major earthquake, accessibility to Mission Bay would be impaired from the north and west. This impaired access could delay emergency rescue and fire control operations and could limit the Project Area's usefulness as a potential evacuation site for residents of potentially heavily damaged sections of northeast San Francisco.

- Liquefaction, including possible lurching and lateral spreading resulting from liquefaction, and rapid settlement are the types of seismically induced soil failure likely to occur in the Project Area./40/ The area between Third and Fifth Streets, north of China Basin Channel, would be at greatest risk from liquefaction. This area contained unequivocal evidence of ground failure following the great 1906 earthquake./21/ The likely impacts of strong groundshaking in other parts of the Project Area, particularly south of the channel, are less well documented. However, preliminary tests suggest that much of this fill material is less susceptible to liquefaction than that north of the channel./40a/ While no ground failure features were reported in this area after the 1906 event, much of the area was underwater at the time and few people occupied the area. Minor ground failure may have gone unreported in this area.

Building Types

Because of the variety of land uses proposed, several building types would be used at Mission Bay. Table VI.K.3 summarizes some general information about the response of building types to groundshaking. Well designed and carefully constructed new buildings can be expected to remain standing after a major earthquake, but there is wide variety in the amount of expected damage due to groundshaking, the major cause of structural damage./45/ Light metal and wood frame buildings would respond best to groundshaking, and damage for those types of buildings would be less than 10%. Steel-frame buildings would be expected to perform well but would suffer somewhat more damage, mostly non-structural. Reinforced concrete buildings are more susceptible to damage than light metal, wood frame, and steel-frame structures. Tilt-up concrete buildings would be expected to undergo the worst damage, especially if they are poorly tied together. Unreinforced masonry buildings perform poorly during seismic activity and are not recommended or expected to be built at Mission Bay./46/

Damage to Infrastructure

During a major earthquake, there would be substantial damage to roads, bridges, sewers, water mains, utility conduits, and other infrastructure elements, similar to other areas in northeast San Francisco./40/ Roads and underground utilities north of the channel and west of Fourth Street are likely to experience general severe damage resulting from extensive liquefaction, such as cracking and buckling of the pavement and bending and

TABLE VI.K.3: BUILDING TYPES WHICH MAY BE USED AT MISSION BAY

Building or Foundation Type	Potential Use	Floors	Expected Damage Based on Seismic Design of Building/a/ Ordinary Design	Expected Damage Based on Seismic Design of Building/a/ Superior Design	Comments/b/
Wood Frame	LDR, S/LI/RD, M-2, Port-Related Community Facilities	1-3	5-10%	5-10%	Generally withstands earthquakes well (except for those built over parking structures/c/). Damage common around large openings. Should be bolted to foundation. Can include leveling jacks to compensate for differential settlement. Masonry chimneys increase likelihood of damage.
Light Metal Frame	S/LI/RD, M-2, Port Related	1-3	0-5%	0-5%	Generally performs very well. Bracing often bent or pulled out.
Concrete Tilt-Up	Offices, S/LI/RD	1-3	27-30%	0-18%	Roof-to-wall and wall-to-frame connections must be secure for adequate performance in earthquakes. Large openings and windows decrease building integrity. Can perform well if they include walls which are well-connected to the foundation and strong connections on precast panels, but past experience has shown that they often perform exceptionally poorly.
Reinforced Concrete	Offices, S/LI/RD, HDR, MHDR, MDR, Community Facilities	Any	17-22%	0-12%	Can perform well. Non-structural damage common. Must include reinforcement and construction and installation details to increase ductility. Curtain walls are more susceptible to damage than cast-in-place walls. Requires careful design of shear walls.
Steel Frame	Offices, S/LI/RD, HDR, MHDR, MDR, Community Facilities	Any	12-17%	0-10%	Most earthquake-resistant type because structures are relatively light and can be damaged extensively without collapse. Often suffer major nonstructural damage. Masonry infill walls and precast curtain walls may not perform well. Concrete or masonry shear walls (to form dual bracing system) generally perform well.

/a/ Percentage expected damage to building types from violent shaking (B on the San Francisco scale of groundshaking intensity) for buildings incorporating either ordinary or superior earthquake design as described in "Building Stock and Earthquake Losses - The San Francisco Bay Area Example," ABAG, pp. 17-20, May 1986.

/b/ These comments refer to well-designed, well-maintained buildings which do not have complex geometries or peculiar shapes. Large openings can reduce structural integrity. The categories include the most common building types normally used in the Bay Area. Other less common construction types may be used at Mission Bay.

/c/ Parking structures constructed of concrete, steel, or masonry tend to perform poorly. Partial or full collapse of the parking structure can result in greater damage to the wood-frame portion of the building than normally would be expected.

SOURCE: Environmental Science Associates, Inc.; EQE, Preliminary Earthquake Risk Assessment of Mission Bay Project, 1986; ABAG, 1986, "Building Stock and Earthquake Losses - The San Francisco Bay Area Example."

breaking of pipes, resulting in loss of utility service. Liquefaction damage also could be locally severe south of the channel and lurching could damage roads and utilities near the waterfront and the channel. Broken fuel lines would increase the likelihood and severity of fire. Additional water supplies for firefighting, such as cisterns or pumps to take water from the Bay, would be needed to fight fires after a major earthquake.

- Following a major earthquake, street access to the portion of the site south of the channel could be limited to 16th Street, which passes under I-280, and Third Street at the southern part of the site. Third Street would likely be impassable at the channel because of settlement of up to two feet at the bridge approaches./40/ The bridge approaches could be made serviceable in a relatively short time if heavy equipment were available. The Third Street Bridge would probably be stuck in its position at the time of the earthquake, most likely in the down position, due to damage to the bridge-raising mechanism. It is expected that the counterweight on the Fourth Street Bridge would be damaged, making the bridge unusable for some time./40/ The new Owens Street bridge in Alternatives A and B is likely to withstand the earthquake in usable condition; however, unless the approaches are engineered to avoid ground failure effects, it would also be impassable until heavy equipment is available to clear and grade the approaches. It is very likely that elevated highways would suffer considerable damage; however, it is unlikely that general collapse would occur. The elevated highways may not be passable following a large earthquake, but this should not block access to and egress from Mission Bay./40/

Access north of the channel could be impaired because of debris from damaged older existing buildings nearby. Warping and fracturing of pavement would result from liquefaction, uneven settlement and lurching. Some of the roads probably would be passable in trucks and four-wheel drive vehicles./40/ Severely damaged or debris-blocked roads could be made usable in a relatively short time through use of heavy equipment.

Affected Population

Employee and resident populations for Mission Bay are summarized in Table VI.K.4. The area has been subdivided into two parts:

- the north of China Basin Channel area, which in the event of a major earthquake likely would not be cut off from emergency services based north and west of Mission Bay; and

TABLE VI.K.4: POPULATION AT MISSION BAY SUBJECT TO SEISMIC HAZARD/a/

		2000			Build-Out/2020		
	1985	Alt. A	Alt. B	Alt. N	Alt. A	Alt. B	Alt. N
North of China Basin Channel							
Residents		0	3,200	0	1,700	6,900	0
Employed Residents		0	2,100	0	1,300	4,100	0
Unemployed Residents		0	1,100	0	350	2,700	0
Employees (Project Buildings)	0	5,200	270	3,600	17,000	370	5,500
Employees (Pre-1985 Buildings)	2,000	130	180	160	---	---	---
2:00 a.m. Population/b/		500	3,200	0	2,200	6,900	0
2:00 p.m. Population/c/		5,600	1,600	3,700	17,000	3,100	5,500
South of China Basin Channel/d/							
Residents	34	5,500	1,900	36	13,000	12,000	36
Employed Residents		3,300	1,000	26	7,400	7,100	26
Unemployed Residents		2,200	880	10	5,200	5,300	10
Employees (Project Buildings)	0	3,900	4,200	1,900	8,500	5,900	11,700
Employees (Pre-1985 Buildings)		730	900	1,500	---	---	---
2:00 a.m. Population/b/		5,900	1,900	36	13,000	12,000	36
2:00 p.m. Population/c/		7,000	6,000	3,400	14,000	11,000	12,000
TOTAL PROJECT AREA							
Residents	34	5,500	5,100	36	15,000	19,000	36
Employed Residents		3,300	3,100	26	8,700	11,000	26
Unemployed Residents		2,200	2,000	10	5,600	8,000	10
Employees (Project Buildings)	0	9,100	4,500	5,500	26,000	6,300	17,000
Employees (Pre-1985 Buildings)	2,000	860	1,000	1,700	---	---	---
2:00 a.m. Population/b/	34	6,400	5,100	36	15,000	19,000	36
2:00 p.m. Population/c/	2,000	13,000	7,600	7,100	31,000	14,000	17,000

/a/ Numbers may not add due to rounding. Visitors are not included in the population totals, but an unknown number of visitors would also be at risk.

/b/ 2:00 a.m. population consists of residents plus 500 hotel guests (for Alternative A).

/c/ 2:00 p.m. population is assumed to consist of employees, unemployed residents, and 200 hotel guests (for Alternative A).

/d/ Includes houseboats on channel (moored on the south side).

SOURCE: Recht Hausrath & Associates and Environmental Science Associates, Inc.

- the combined east and west of Third Street areas south of China Basin Channel, which might be accessible only from the south until heavy equipment is available for clearing of bridge approaches and access streets.

Predictions of injuries and death can be made based on the exposed population, the kinds of building construction, and the intensity of groundshaking and ground failure. The population figures in Table VI.K.4, p. VI.K.38, can be used in conjunction with predicted death and injury rates based on structural damage for buildings shown in Table XIV.I.2, on p. XIV.I.2 in Appendix I, to estimate casualties. Visitors to the Project Area would be exposed to seismic hazards, but it is not possible to estimate their number reliably. Casualties (deaths and injuries) have been projected for each phase of Alternatives A, B and N. Those projections assume a worse-case earthquake scenario and are intended as estimates of the likely magnitude of casualties. They are not exact predictions of injuries or deaths and are based on assumptions that may or may not be realized in a major earthquake striking the area.

Collapsing buildings, shattering windows, falling exterior cladding and other decoration, falling masonry walls and chimneys are common causes of casualties in an earthquake. Pedestrians as well as building occupants would be exposed to these hazards. Additional casualties to building occupants could be caused by nonstructural damage, such as sliding furniture, falling bookcases, collapse of suspended ceilings, tipping filing cabinets, or any heavy object stored or displayed where it could fall.

Houseboats would be primarily affected by water movement in China Basin Channel, possibly as a result of a tsunami. The main hazard would be collisions with docks and other boats, or ground failure due to soil lurching along the waterfront. The boats may suffer a cutoff of utility services because of broken water lines, power lines, etc.

If an earthquake were to occur during construction of a building, damage to the partially completed structure could be severe and excavations would be subject to possible failure. Furthermore, the construction equipment, such as cranes, or building materials could fall or move. If the earthquake were to occur during working hours, construction workers would be at risk, as would passersby at any time.

During a major earthquake, property damage and human injury described above would occur, at other parts of the City to a lesser or greater degree. The downtown and South of Market areas could be severely affected because of the high density of development, large number of older buildings and generally poor soil conditions, including large areas of fill.

The citywide need for emergency response would result in heavy demand for service providers, including the Police Department, Fire Department, ambulance service, hospitals, and utility repair crews. Services for the city as a whole would be pushed to their limits; no one area of the City would receive a full, normal level of attention.

Access to Mission Bay for emergency response probably would be available for the area north of China Basin Channel. Although streets would suffer disruption and some debris blockage, trucks and four-wheel-drive vehicles should be able to access the area. Repairs to streets would include levelling of the surface and removing accumulated debris and could take hours to days, depending on the availability of personnel and heavy equipment.

The area south of China Basin Channel likely would have poorer access in the aftermath of an earthquake. The Fourth Street Bridge likely would be severely damaged and would be unusable for a long period. The Third and new Owens Street bridges would be temporarily unusable due to settlement of approaches; with heavy equipment, the approaches could be repaired within a few hours. Sixteenth Street may be blocked by debris from the I-280 elevated freeway, but collapse of the freeway is not considered likely./40/ Third Street would be damaged by soil failure but would be usable by trucks.

The port-related facilities on China Basin Channel and the Bay would be damaged by lateral spreading and lurching of soils towards the water./40/ Additionally, the Third Street Bridge will probably be stuck in the down position, preventing access to China Basin Channel except for very small boats. Some piers along the Bay should be serviceable.

Railroad lines at the site could include the existing Southern Pacific line (also used by CalTrain Commuter Services) and a proposed MUNI extension. Rail service to Mission Bay would probably be unavailable for a long period after a major earthquake. The Southern Pacific tracks would be subject to damage from debris from the I-280 freeway overpass and would probably be closed. Liquefaction, ground lurching and differential settlement likely would result in significant damage to the rails, requiring weeks or months to repair (when the larger picture of San Francisco and San Mateo County rail lines are considered). The proposed MUNI Metro line would suffer damage.

The above consideration of emergency vehicle access to Mission Bay south of the channel is indicative of a potential severely limited emergency response in the aftermath of a major, damaging earthquake. While that area would not be cut off from the rest of the City, it could be severely disadvantaged with regard to immediate emergency response from the north. That is, emergency services are likely to be available first to areas that are more easily accessible. Thus, it is possible that other areas of the City may receive emergency response services for many hours following an earthquake before access is opened to Mission Bay. It is possible that emergency services could reach the Project Area from the Port.

While portions of Mission Bay may be disadvantaged from the viewpoint of emergency access, the newer buildings, if they incorporate superior design measures that meet more stringent seismic safety standards, may themselves respond more safely and help to hold down casualties in comparison to other areas of the City. However, this consideration is significant only in a relative sense when comparing Mission Bay to other neighborhoods in San Francisco. Casualties at Mission Bay are a certainty; emergency access is uncertain.

The resources of the Office of Emergency Services would be stretched to capacity by a major earthquake. No special attention could be expected by occupants of the Project Area or any other part of San Francisco. In general, neighborhoods should expect to be self-sufficient for up to three days.

Whether or not development occurs at Mission Bay, the difficulty of reaching the area after a major earthquake would limit its usefulness as a place to which residents of more densely populated areas, such as the Tenderloin, could be evacuated. For those people in the Project Area when a major earthquake occurs, nearby open spaces could be used as evacuation sites if it were necessary to leave unsafe buildings. Ground failure in the vicinity would almost certainly leave the open space areas severely disrupted, limiting their usefulness.

An earthquake during the afternoon commute period would expose more pedestrians to danger from falling debris from buildings and direct effects of ground failure than one occurring at other times of the day. Concentrations of pedestrians would be greatest near the CalTrain depot. The likely pedestrian casualties cannot be predicted because no factors are available./47/

An earthquake during working hours or commute periods would separate many people from their homes because of damage to railroads, BART, bridges, elevated freeways, and major roads. A large number of workers would likely be dependent on local resources for up to three days. Traffic on passable roads during that period would be heavily congested, further delaying emergency response.

The casualty estimates given in the following paragraphs do not include casualties occurring after the earthquake which could be attributed to fire, the stress of evacuation, or the generally difficult condition of coping with a major disaster. The elderly and chronically ill would be particularly vulnerable to such hardships.

Alternative A

At build-out a total of about 15,000 people would be affected by a 2 a.m. earthquake./48/ About 13,000 would be south of the channel. If a 12 to 22% damage rate for steel frame or reinforced concrete construction is assumed, then 45 to 50 minor injuries and five to ten serious injuries and deaths would be expected in the Project Area.

An early afternoon earthquake would affect about 31,000 people, of which about 14,000 would be south of the channel. Assuming the same building conditions as for the 2 a.m. earthquake, there would be about 95 to 100 minor injuries and 15 to 20 serious injuries and deaths in the Project Area.

During the evening commute period, substantial numbers of pedestrians would be concentrated near the CalTrain station at Seventh and Channel Streets and near the offices north of the channel. The Seventh and Channel area would be subject to debris falling from I-280.

Initial Phase of Development. After the initial phase, about 1,000 residents of the Project Area, visitors, and 1,500 employees would be subject to the hazards of a major daytime earthquake. If the MDR units were constructed of wood or light metal frames, no casualties would be expected. If they were constructed of reinforced concrete or with steel frame, fewer than five minor injuries would be expected. If 12% to 22% damage rates occurred to office and S/LI/RD buildings, then there would be about five minor injuries. There would be a total of fewer than ten casualties in the Project Area.

Alternative B

The 2 a.m. population affected by a nighttime earthquake would be about 19,000. About 12,000 would be south of the channel. If the housing south of the channel were wood frame and suffered damage of 5 to 10%, fewer than five injuries fewer than two serious injuries or deaths would be expected. If buildings were steel frame or reinforced concrete with 12 to 22% damage, there would be 35 to 40 minor injuries and five to ten serious injuries and deaths. North of the channel there would be 20 to 25 minor injuries and fewer than five serious injuries and deaths.

At 2 p.m. there would be about 14,000 people in the Project Area. About 11,000 would be located south of the channel, when total casualties in wood frame buildings would be fewer than five. If the buildings were steel frame or reinforced concrete, casualties would include 30 to 35 minor injuries and five to ten major injuries and deaths. North of the channel there would be five to ten minor injuries and fewer than three major injuries and deaths.

During the afternoon commute period, pedestrians would be concentrated near the office buildings on Owens Street and at the CalTrain depot at Seventh and Channel Streets. Both areas would be subject to debris falling from I-280.

Initial Phase of Development. After the initial phase is occupied, about 800 residents would be subject to a nighttime earthquake. If light-metal or wood frame construction were used, no casualties would be expected. If steel-frame or reinforced-concrete construction were used, fewer than five minor injuries would be expected. Office and retail space with about 1,400 employees in steel-frame or reinforced-concrete would result in fewer than five casualties. For the Project Area, fewer than ten minor casualties would be expected.

Alternative N

A nighttime earthquake would affect fewer than 50 people. About 17,000 would be affected by a daytime earthquake. The afternoon event would be expected to cause 50 to 55 minor injuries and about 10 serious injuries and deaths if buildings were steel frame or concrete with 12 to 22% damage. There would be about five minor injuries and fewer than two serious injuries or deaths expected if wood frame or light metal frame construction were used.

During the afternoon commute period, pedestrians would be concentrated at the CalTrain station located at Fourth and Townsend Streets.

Tsunami and Seiches

The 100-year tsunami (1% chance of occurring in any one year) would have a project runup elevation along the Mission Bay shoreline of -3.8 feet, San Francisco datum. That event would raise water levels in China Basin Channel but would not cause flooding at Mission Bay. Houseboats docked in the channel could be damaged from collisions with docks. The 500-year tsunami (0.2% chance of occurring in any one year) would have a runup elevation of -0.6 feet, San Francisco datum. Flooding of the central portion of the Project Area with several feet of water would result in substantial property damage and inconvenience to occupants.

A seiche in San Francisco Bay would have less effect than the tsunami caused by the same earthquake./22/

MITIGATION

GEOLOGIC SITE DEVELOPMENT CONSTRAINTS

Areal and Differential Settlement

Measure	Alternative	Description
K.1	A,B,N	Conduct a comprehensive boring, sampling, and testing program to determine the engineering properties of the soil as is required by the building permit process. Using the results, establish a detailed description of the rate and amount of settlement which would occur on the site and determine the potential for plastic flow and mud wave development. This would include an evaluation of differential settlement. It would be used as part of the information needed to: – determine appropriate layout and slope of surface drainage systems, storm drains, and sewers; – select and design appropriate foundations; – determine amount of settlement which would occur between each building and its utility connections and sidewalks; – determine the rate of loading of soil and potential for mud wave development near the shoreline; and – site emergency facilities and infrastructure (see Mitigations K.17 and K.18).
K.2	A,B,N	Use pile-supported buildings wherever engineering practices indicate they are needed based on soils reports prepared as required by the Bureau of Building Inspection. That would reduce the need for excavation and mitigate some impacts of settlement and seismic events. Other foundation types providing equivalent mitigation against settlement or other structural damage due to seismic impacts also may be used. Using pile-supported buildings would mitigate the need to dewater and test and dispose of soil, and would improve seismic performance. It would minimize the amount of

Measure Alternative Description

soil excavated for foundations. As little as one foot of soil over the footprint of each building could be excavated for pile foundations whereas approximately five feet could be removed for the compensating foundation of a five-story building. For Alternatives A, B, and N, it is generally estimated that the amounts excavated could be reduced by 60%, 75%, and 40%, respectively, of the amounts shown for build-out in Table VI.K.1, p. VI.K.20, if all buildings were pile-supported and no shallow foundations were used.

• However, although buildings on piles would not settle because the weight would be supported by stiff sediments or bedrock, the surrounding soil would continue to settle, resulting in disturbance or damage to infrastructure connections to the buildings if flexible materials are not used in the connections.

An earthquake would affect pile-supported buildings less severely than buildings with shallow foundations for the following reasons:

• - Liquefaction in unconsolidated, saturated, sandy sediments would not cause extensive damage to pile-supported buildings.

• - Accelerated settlement of unconsolidated sediments, due to groundshaking, would not directly affect pile-supported buildings.

The following measures would mitigate the impacts of using piles:

K.2a Retain qualified soils engineers to design and evaluate the use of piles, as required by the building permit process. The following actions would occur:/49/

- design, execution, and evaluation of a thorough test boring program;
- determination that satisfactory materials are found along the bearing length of the piles as well as below the tips of the piles;

Measure	Alternative	Description
		– consideration of downdrag on the pile due to fill overlying compressible soils; and – engineering supervision by soils engineers for every pile installed.
• K.2b		Design connections between the fixed, pile-supported structures and unsupported sidewalks and driveways to reduce the likelihood of separation due to settlement. The sidewalks and driveways would require special strengthening to withstand the stress created between stationary buildings and settling soil.
K.2c		Design flexible connections for utilities serving pile-supported buildings which would be adequate to accommodate the settlement expected in the surrounding soil. These could be similar to current installation practices by the Department of Public Works, which uses water, gas, and sewer line materials that are more elastic than those used earlier, with more flexible mains and joints. In addition, lines are laid in six-foot segments which also affords increased flexibility.
K.3	A,B,N	Use existing piles to support new structures, eliminating the expense of driving new piles, if feasible and appropriate. However, it would be necessary to evaluate the integrity and load-bearing capacity of the existing piles with respect to requirements of structures intended for the site. In addition, it would be necessary to design buildings so that their footprints would be adequately supported by the pattern of the existing piles.
• K.4	A,B,N	If shallow foundations are used for any buildings, install leveling jacks as part of the foundation or use other

	Measure	Alternative	Description
•			available methods to compensate for differential settlement based on soil engineering recommendations.
•	K.5	A,B,N	Use surcharging and vertical drains to accelerate settlement if site-specific soils studies indicate need. Produce detailed schedule of settlement rates and amounts before implementation of a surcharging program. Develop this schedule only after detailed soil samples were taken to evaluate the engineering characteristics of the underlying soils as described in Mitigation K.1. That would partially mitigate the impacts of areal and differential settlement. The amount of areal and differential settlement which would occur after construction would be reduced, thus reducing impacts to infrastructure connections to the building and the functioning of surface drainage systems, storm drains, and sewers. This technique could be used to prepare building sites and adjacent areas so that shallow foundations could be used in areas where presently less than six inches of settlement is expected in the next 30 years. Two to five feet of soil would be placed on the areas being surcharged, probably for one to two years before the beginning of construction on the surcharged area. This would be a continuing source of air and water pollution due to blowing dust and erosion by rainfall which would extend beyond the normal construction period. Impacts of the measure may be mitigated by the following actions:

Measure	Alternative	Description
K.5a		Cover, coat, or seed the bare dirt to protect it from wind and rainfall.
K.5b		If appropriate, use soil excavated from foundation sites as surcharge or fill within other parts of the Project Area to minimize transport of soil.
Groundwater Levels		
K.6	A,B,N	Keep basements above the water table so that dewatering would not be necessary. The rate and amount of settlement would not be increased due to removal of groundwater, and maintenance of pumps and drainage systems would not be required. Construct project streets at existing grades or above, reducing the amount of soil excavation and the potential for encountering groundwater during cutting for utility trenches.
K.7	A,B,N	As required by City guidelines, design surface drainage systems, storm drains, and sewers so that after settlement, the slopes would be adequate for them to function properly.
Corrosive Soils		
• K.8	A,B,N	Test soils for sulfate and chloride content. If necessary, use admixtures in concrete so it would not be susceptible to attack by sulfates, and/or use coated metal pipes so that pipes would be more resistant to corrosion by chlorides.

Measure	Alternative	Description
SEISMIC HAZARDS		
Groundshaking		
• K.9	A,B,N	Adopt and enforce, as a minimum, the seismic standards of the 1988 Uniform Building Code (UBC), to reflect recent advances in seismic standards and thus incorporating them into building design and construction./50/
•		Since publication of the Draft EIR the City of San Francisco has adopted the building standards of the 1988 UBC (as mandated by State law), incorporating them into the 1990 San Francisco Building Code. Where K.9 is referenced in the Draft EIR or in Volume Four, Summary of Comments and Responses, it is here acknowledged that impacts that would be mitigated by K.9 are now effectively mitigated due to the City's adoption of the 1988 UBC.
K.10	A,B,N	Require studies that would test the performance of exterior cladding and glazing materials during seismic events and determine those least dangerous particularly to pedestrians. This information could be incorporated into the San Francisco Building Code and implemented in new developments. This would result in the use of less dangerous materials on building exteriors throughout San Francisco.
K.11	A,B,N	Consider peer review for the design of structures at Mission Bay to ensure that state-of-the-art practices have been used. Studies indicate that state-of-the-art

Measure	Alternative	Description
		practices are generally not used./51/ Use of large windows and openings, irregular configurations, and precast concrete panels has been increasing. Each of these features increases the potential for poor performance during an earthquake. Designers are also not using appropriate standards for redundancy, ductility, toughness, compatibility, configuration, size, deformation, shear wall definition, and the need to connect building components./52/ Such a measure would require the City to normally establish or designate a group of qualified geotechnical and structural engineers.
•		Without waiting for the UBC or San Francisco Building Code to make use of recent advances in engineering practice, incorporate into building designs recently acquired knowledge about structural performance in earthquakes to the extent appropriate. Require the use of spectral response analysis to determine the behavior of specific mid-rise structures sited on thick, soft clay sediments, in response to low-frequency waves.
K.12	A,B,N	Require that all materials and equipment, including cranes, be firmly secured as feasible in buildings that are under construction and that appropriate safety harnesses be used by exposed construction workers.
K.13	A,B,N	Require and certify a quality assurance / quality control (QA / QC) program to ensure that materials and construction meet design standards.
K.14	A,B,N	Require bracing or reinforcement of nonstructural features in non-residential structures to prevent casualties and property damage. The items which would be evaluated include computers; heavy ceiling fixtures like lights, ducts, diffusers, and pipes; exterior signs; exterior pre-cast panels or cladding; emergency power generators; elevators; valuable or fragile artwork; water heaters; natural gas

	Measure	Alternative	Description
			pipes; tall file cabinets; tall storage racks, bookcases, and shelving; fire extinguishers and fire sprinklers; large electrical equipment, especially transformers; communications systems; and water tanks./54/
●			Require that residential units have braced water heaters, and that chimneys in wood-frame buildings should not be of masonry materials unless they are reinforced construction./53/
	Ground Failure		
●	K.15	A,B,N	Make sandy soil more dense if determined necessary so that liquefaction and lurching would not cause significant impacts to structures not otherwise protected against liquefaction. This should be done in areas where shallow saturated sandy material is found during the subsurface geotechnical studies to be performed to evaluate site conditions.
	K.16	A,B,N	Require automatic shut-off devices on natural gas lines leading to structures.
	Emergency Response		
	K.17	A,B,N	Require formulation of an emergency response plan for the Mission Bay Area and integrate it into emergency response planning for San Francisco. An emergency response plan should include the following components: – employee organization; – employee training; – communications; – equipment list; – procedures; – command post; – building survey; – evacuation; – medical; – security; and – clean-up.

Measure	Alternative	Description
		It should apply to each building or complex in the Project Area and should be the responsibility of the owners of each building or complex, and should be reviewed by the City periodically to ensure it is kept up to date.
K.18	A,B,N	Site and design emergency facilities so that they would remain functional after a major earthquake. The following standards should be used if feasible: – Construct emergency facilities using foundation design techniques that provide maximum seismic safety. – Do not site emergency facilities where more than two inches of settlement is expected during the next 30 years. – Locate emergency facilities away from elevated freeway structures which could shed debris or collapse in a major earthquake, damaging the facility or making it inaccessible. – Design redundant infrastructure connections. – Design a conservative structure which would be likely to suffer limited damage in a major earthquake (equivalent to Level of Risk 2 construction as described in the Community Safety Element of the San Francisco Master Plan)./54a/ – Provide emergency generators at all important facilities such as fire stations, police stations, hospitals, emergency shelters, and pump stations for water and sewage, to provide backup power. Generators should be located at ground level and should not be mounted on spring isolation systems unless they are specifically designed for seismic loads. Cooling and fuel supply systems for the generators should be adequately anchored to prevent damage during an earthquake. Batteries used either as starters or emergency electrical systems should be stored in low profile battery racks and adequately anchored to the floor to prevent sliding and overturning. Battery rack frames should have sufficient strength to withstand lateral loads from the batteries. A noncorrosive padding should be placed between each battery and between the batteries and side support rails to prevent relative movement between the batteries./54/

	Measure	Alternative	Description
			- Install emergency communication equipment, such as two-way radios or microwave equipment. - Brace, anchor, and protect non-structural components.
●	K.19	A,B,N	Build a mass care facility, which would incorporate an area in which helicopters could land on an emergency basis. It should also have an auditorium, cafeteria, and restrooms. If a school is built in the Project Area, design it to serve as a mass care facility accessible from all parts of the Project Area.
●			Equip the mass care facility with medical supplies and provisions for emergency medical care available within the Project Area. Design community facilities that do not normally provide emergency services so that they may be used after an earthquake to administer emergency services to supplement the primary mass care facility. Supply the mass care facility with food, water, and supplies to last three days, and tents to provide temporary housing. Tools for hand-digging pit toilets should also be stored at the mass care facility.
●	K.20	A,B,N	Provide cisterns in the Project Area to store water and suction hydrants to use Bay water for fighting fires.
	K.21	A,B,N	Store within the Project Area heavy equipment that could travel on damaged roads, clear debris, and open access to the Project Area after a major earthquake.
	Damage to Infrastructure		
	K.22	A,B,N	Construct infrastructure features with redundancy and flexibility to prevent failure during a major earthquake. Specifically:/54/ - Provide another east-west access road, constructed on seismically stable ground or on fill engineered to be stable, to the site under I-280 in addition to 16th Street where I-280

Measure	Alternative	Description
		has been determined to be safe from danger of collapse. Alternatively, do a detailed seismic analysis of I-280 at 16th Street and retrofit it as necessary so that it would not cause 16th Street to be impassable after a major earthquake. – Perform remedial strengthening and repair on the Third and Fourth Street bridges. – Prepare contingency plans to ensure that emergency repairs to the bridge approaches can be made promptly. – Place MUNI Metro tracks west of the zones where settlement of more than two inches is expected where feasible. – Provide good anchorage for all electrical system components such as transformers and switchgear. Where relative movement is likely to occur between equipment, flexible connections or slack should be used to accommodate differential displacement. Slack should also be provided in underground cabling when it is installed. – Use flexible couplings or welded steel pipe for pipelines. For communications conduit, steel usually performs better than polyvinyl chloride. Ductile iron and steel perform much better than cast iron or concrete pipes for drinking water supply or sewers. – Ensure that state-of-the-art information is applied to the design of infrastructure.
K.23	A,N	Perform seismic rehabilitation of vacant Firehouse 30 at Third, Fourth, and Mission Rock Streets.
• K.24	A,B,N	The following pertains to the use of hazardous materials at Mission Bay:/55/

•

Measure	Alternative	Description
●		
●		– Conduct periodic inspections of non-structural features of buildings in which hazardous materials are located. Non-structural hazard mitigation in this special case should include proper maintenance and contingencies for power loss. It could also include, if appropriate, seismic restraints, special pipe connections, safety shutoffs, special gas storage tanks, and secondary containment. This measure would be in addition to existing City requirements regarding permitting procedures for the storage and handling of toxic materials and underground storage tanks (Ordinance #443-86, Health Code Part II, Chapter V, Article 21 San Francisco Municipal Code); and maintenance by the San Francisco Fire Department of an inventory of hazardous materials, as required by state law AB 2185.

NOTES

SETTING

/1/ Dames and Moore, Preliminary Report, Geotechnical Consultation, Mission Bay Development, San Francisco, California, April 15, 1982.

/2/ Dames and Moore, Geotechnical Consultation, Mission Bay Project, December 1, 1982.

/3/ Harding Lawson Associates, Stadium Feasibility Analysis: A Study of Alternatives for a Stadium for the City of San Francisco, v.1, Research and Data, Appendix D, Geotechnical Site Evaluation Reports, 1983.

/4/ San Francisco datum is a local reference elevation equivalent to about 8.6 feet above mean sea level.

/5/ Wahrhaftig, Clyde, A Streetcar to Subduction and Other Plate Tectonic Trips by Public Transport in San Francisco, California, Revised Edition, American Geophysical Union, 1984.

/6/ Serpentine minerals and rocks are alteration products of rocks which formed deep in the earth. They have been squeezed up to the surface by the collision of immense plates of the earth's crust when one plate is subducted under another. Melange is a mixture of crushed fragments of all the rocks brought together during subduction.

/7/ Goldman, Harold B., "Geology of San Francisco Bay," in Harold B. Goldman, editor, Geologic and Engineering Aspects of San Francisco Bay Fill, California Department of Conservation, Division of Mines and Geology, Special Report 97: 11-29, 1969, p. 18.

/8/ Robert Darragh, Dames & Moore, telephone conversation, June 4, 1987.

/9/ Schlocker, Julius, Geology of the San Francisco North Quadrangle, California. U.S. Geological Survey, Professional Paper 782, 1974.

/10/ Overconsolidation is the decrease of void space between grains which is greater than the present load would cause. It usually results from desiccation of the sediments or from pressure which has since been removed. In the case of old bay clay, the overconsolidation was caused by a lowering of sea level and subsequent drying of the clay.

/11/ Pile-supported sewers are the following: Sixth Street Sewer from Channel south halfway to 16th Street; C-4 Sewer along the south side of the Channel between Fourth and Sixth Streets; 16th Street Sewer from Owens to Third Streets; Berry Street Sewer from Fourth to Seventh Streets; and the Fourth, Fifth, and Sixth Street Sewers from Berry Street to Channel outfalls. Older pile-supported buildings include the old cold storage warehouse at China Basin Channel and Fifth Street, two buildings west and one building south of the cold storage warehouse, the Central Warehouse Company structure, the new magazine building west of Sixth Street, the boiler house on Townsend Street between Fourth and Fifth Streets, and the Pacific Motor Trucking garage at Sixteenth and Sixth Streets.

Information on the sewers was provided by Dan Champeau, Clean Water Program, telephone conversation, May 12, 1988.

/12/ Lee, Charles H. and Michael Praszker, "Bay Mud Developments and Related Structural Foundations," in Harold B. Goldman, editor, Geologic and Engineering Aspects of San Francisco Bay Fill, California Department of Conservation, Division of Mines and Geology, Special Report 97: 43-85, 1969.

/13/ Active faults are those which have a historic record of activity or other geophysical evidence of movement within approximately the last 10,000 years.

/14/ Real, Charles R., Probabilistic Long-Term Forecasts of Major Earthquakes in the San Francisco Bay Region, Bay Area Earthquake Study, 1984.

/15/ The Richter Scale measures magnitudes of earthquakes based on the amount of energy released. It is a logarithmic scale, with each full point increase representing 30 times as much energy release as the previous point (for example, a magnitude 5 earthquake releases 30 times as much energy as a magnitude 4 earthquake). The Federal Emergency Management Agency has estimated that the 8.3 Richter magnitude is the estimated largest magnitude earthquake that could be expected to strike the Bay Area at a reasonable level of probability, and that the main shock can be expected to be followed by large aftershocks over a period of weeks or longer. Each large aftershock would be capable of producing additional significant damage and hampering disaster assistance operations.

/16/ San Francisco Department of City Planning, Downtown Plan Environmental Impact Report, EE81.3, 1984.

/17/ Ancient faults include the San Bruno Fault and the City College Fault Zone. In addition, several smaller inactive faults or shear zones are located near Telegraph Hill, Potrero Point, and the James Lick Freeway. Seismic events centered on the Maacama, Healdsburg-Rodgers Creek, Green Valley, Concord, Antioch, Greenville, and San Gregorio Faults are not expected to cause serious impacts in San Francisco.

/18/ Borcherdt, Roger D., James F. Gibbs, and Kenneth Lajoie, Prediction of Maximum Earthquake Intensity Predicted in the San Francisco Bay Region, California, for Large Earthquakes on the San Andreas and Hayward Faults, U.S. Geological Survey, MF-0709, 1975.

/19/ Perkins, Jeanne B., The San Francisco Bay Area -- On Shaky Ground, Association of Bay Area Governments, February 1987.

/20/ Groundshaking in San Francisco is classified on a five-point scale ranging from A (very violent) to E (weak).

/21/ Lawson, Andrew C., et al., The California Earthquake of April 18, 1906: Report of the State Earthquake Investigation Commission, 2v and atlas, Carnegie Institution, Washington, D.C., 1908.

• /22/ Blume, John A., San Francisco Seismic Safety Investigation, Geologic Evaluation, URS Associates, June, 1974.

/23/ Ground failure here includes liquefaction, subsidence, and lateral spreading. Liquefaction is the transformation of clay-free granular material, such as loose, wet sand, into a fluid-like state similar to quicksand. It occurs as a result of groundshaking during an earthquake. Subsidence is a lowering of the ground surface from settlement of the soil. This can occur from earthquake groundshaking, withdrawal of groundwater, or other causes. Lateral spreading is the horizontal movement of soil or fractured rocks when there is liquefaction or plastic flow of adjacent soil.

• /23a/ Davis, James F., John H. Bennett, Glenn A. Borchardt, et al., Earthquake Planning Scenario for a Magnitude 8.3 Earthquake on the San Andreas Fault in the San Francisco Bay Area, California Department of Conservation, Division of Mines and Geology, Special Publication 61, 1982.

/24/ Bates, Robert L., and Julia A. Jackson, Editors, Glossary of Geology, Second edition, American Geological Institute, Falls Church, Virginia, 1980.

/25/ Garcia, A.W. and James R. Houston, Type 16 Flood Insurance Study: Tsunami Predictions for Monterey and San Francisco Bays and Puget Sound, report prepared for the Federal Insurance Administration, U.S. Department of Housing and Urban Development, 1975.

• /26/ J.R. Ritter and W.R. Dupre, Map showing areas of potential inundation by tsunamis in the San Francisco Bay Region, California, U.S. Geological Survey Miscellaneous Field Studies Map MF-480, 1972.

/27/ The Third Street Bridge does not need strengthening, but some rehabilitation is needed on the concrete piers. The Fourth Street Bridge has a high probability of being damaged in an earthquake because the counterweight tower and the main trunnion columns are severely overstressed. Remedial strengthening of the bridge structure and rehabilitation of its concrete support structures are necessary. Preliminary Earthquake Risk Assessment for Mission Bay Project: Background for Mission Bay Seismic Safety Special Study.

/28/ Thomas Jenkins, Acting Director, Office of Emergency Services, personal interview, March 28, 1988.

/29/ A Mass Care Facility is a location at which temporary lodging, feeding, clothing, registrations, welfare inquiry, first aid, and essential social services can be provided to disaster victims during the immediate/sustained emergency period.

/30/ A Multi-Purpose Staging Area is a preselected location having large parking areas and shelter for equipment and operators and which provides a base for coordinated, localized emergency operations, a rally point for mutual aid coming into an area; and a site for post-disaster population support and recovery activities.

IMPACT

/31/ These assumptions were made to provide a conservative estimate of material excavated. If the assumption that only buildings with superior seismic performance were constructed, it is likely that all would be pile supported and the amounts excavated would be greatly reduced. See Mitigation K.2, p. VI.K.45.

/32/ R.W. Barton, KCA Engineers, telephone conversation, May 27, 1987.

/33/ San Francisco Department of City Planning, September 1986, Soil Conditions, Mission Bay, San Francisco, Dames and Moore Memorandum Number 4.

/34/ The percentage of lot coverage is an estimate based on the assumption that building footprints would not cover the entire lot.

/35/ San Francisco Department of City Planning, September 1986, Canal System, Mission Bay, San Francisco, Section V, Mission Bay Canal Alternatives, KCA Engineers, August 1982.

/36/ CH_2M Hill, study prepared for Jefferson Associates, May 6, 1983.

/37/ R.W. Barton, KCA Engineers, telephone conversation, June 3, 1987.

/38/ San Francisco Department of City Planning, September 1986, Soil Conditions, Mission Bay, San Francisco, Dames and Moore Memorandum Number 5.

/39/ Sewers present an additional problem because the main collection sewers are pile-supported and are not settling. Therefore, sewers serving pile-supported structures have fixed elevations at each end, but subside with the soil elsewhere. There are therefore two connections which may be damaged by insufficiently flexible connections.

/40/ San Francisco Department of City Planning, Preliminary Earthquake Risk Assessment of Mission Bay Project: Background for Seismic Safety Special Study prepared by EQE, 1986.

• /40a/ Hovland, H.J. and Darragh, R.D. "Earthquake-Induced Ground Movements in the Mission Bay Area of San Francisco in 1906," ASCE, 1981.

/41/ Davis, James F., John H. Bennett, Glenn A. Borchardt, et al., Earthquake Planning Scenario for a Magnitude 8.3 Earthquake on the San Andreas Fault in the San Francisco Bay Area, California Department of Conservation, Division of Mines and Geology, Special Publication 61, 1982.

/42/ Steinbrugge, K.V. et al., Earthquake Planning Scenario for a Magnitude 7.5 Earthquake on the Hayward Fault in the San Francisco Bay Area, California Department of Conservation, Division of Mines and Geology, Special Publication 78, 1987.

• /43/ San Francisco Department of City Planning, Preliminary Earthquake Risk Assessment of Mission Bay Project: Background for Mission Bay Seismic Safety Special Study, prepared by EQE, 1986.

/44/ Algermissen, S.T., W.A. Rinehart, James Dewey, et al., A Study of Earthquake Losses in the San Francisco Bay Area: Data and Analysis, National Oceanic and Atmospheric Administration report prepared for the Office of Emergency Preparedness, 1972.

/45/ Perkins, San Francisco Bay Area – On Shaky Ground, February 1987.

/46/ Association of Bay Area Governments, Building Stock and Earthquake Losses – The San Francisco Bay Area Example, May 1986.

/47/ Christopher Rojahn, Applied Technology Council, telephone conversation, February 16, 1988.

/48/ The nighttime earthquake is assumed to occur at 2:00 a.m. when most residents would be at home and no employees would be present. The daytime earthquake is assumed to occur at 2:00 p.m. and employees and unemployed residents would be affected.

MITIGATION

/49/ Charles H. Lee and Michael Praszker, "Bay Mud Developments and Related Structural Foundations," in Harold B. Goldman, editor, Geologic and Engineering Aspects of San Francisco Bay Fill, California Department of Conservation, Division of Mines and Geology, Special Report 97: 51-52, 1969

/50/ The 1987 San Francisco Building Code incorporates by reference major parts of the 1979 UBC. The UBC is updated every three years (the most recent version is dated 1985) and has been changing rapidly with respect to seismic standards.

/51/ Bertero, Vitelmo V., "Strength and Deformation Capacities of Buildings Under Extreme Environments", in Karl S. Pister, editor, Structural Engineering and Structural Mechanics, Prentice-Hall, Englewood Cliffs, New Jersey, 1977.

/52/ California, Seismic Safety Commission, Earthquake Safety: Potentially Hazardous Buildings. Report of the Committee on Hazardous Buildings, Report No. SSC 85-04. Sacramento, California, p. 16-19, November 1985.

/53/ Bay Area Regional Earthquake Preparedness Project, Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide, second edition. BAREPP 85-10. October 1985. p .15-29.

• /54/ San Francisco Department of City Planning, Preliminary Earthquake Risk Assessment of Mission Bay Project: Background for Mission Bay Seismic Safety Special Study, prepared by EQE, 1986.

• /54a/ The Community Safety Element of the Comprehensive Plan, San Francisco, 1974, defines Risk Level 2 in the following way:

> "• No structural collapse or mechanical failure should occur that could cause loss of life.
>
> Mechanical systems may fail to operate but failure of mechanical or architectural elements such as light fixtures, pipes or ducts, suspended ceilings, or elevators should not cause loss of life.
>
> Failure of mechanical systems should be limited to that which can be quickly repaired with minimal outside assistance.
>
> Damage may occur to interior or exterior finishes or to contents of structures.
>
> No damage that would preclude rapid restoration to operational capability should occur.
>
> Applies generally to structures of medium-to-high-density occupancy and structures whose use following a disaster might be desirable but not critical:
>
> - large stores
> - theatres and other places of public assembly
> - office buildings
> - large apartment buildings or complexes
> - large hotels
> - police stations
> - schools
> - jails and detention centers
> - dormitories
> - convalescent hospitals."

/55/ Code of Federal Regulations, Title 40, Chapter 1, Subchapter J, Section 300.68.

L. HYDROLOGY AND WATER QUALITY

SETTING

HYDROLOGIC HISTORY

Mission Bay was once an extensive shallow bay, which had an average depth of one foot at mean low tide. Large areas of tidal flats formed the landward side of Mission Bay. Extensive areas of salt marsh with at least three marshy sloughs reached far inland from the tidal flats. Fresh water drained into Mission Bay from springs on nearby Rincon Hill and from Mission Creek, which maintained a year-round flow.

Between 1865 and 1913, Mission Bay was gradually filled in, and diverse industries and businesses located on the reclaimed land (see VI.J. Cultural Resources, p. VI.J.6). The present China Basin Channel is the last remnant of Mission Creek and Mission Bay. Dredging, shipping activities and wastewater overflows have degraded water quality in the channel./1/

WATER QUALITY MANAGEMENT POLICIES FOR THE PROJECT AREA

State policy for water quality control in California is directed toward achieving the best water quality consistent with the maximum benefit to the people of the state. Beneficial uses of surface waters, groundwaters, marshes, and mud flats for the Project Area are identified in the Water Quality Control Plan, San Francisco Bay Basin, as adopted the by San Francisco Bay Regional Water Quality Control Board and approved by the State Water Resources Control Board. The regulatory background concerning the Basin Plan is described in VI.A. Public Plans, Policies and Permits, p. VI.A.26. The plan has established water quality objectives and discharge prohibitions to attain water quality goals and to protect beneficial uses./2/ Beneficial uses defined for central San Francisco Bay are summarized below. Water quality objectives from the Basin Plan are given in Appendix J. Hydrology and Water Quality, Table XIV.J.1, p. XIV.J.1.

Under stipulations of the Water Quality Control Plan, water quality within China Basin Channel can be maintained at a lower level than would normally be expected. The plan states that "The level of protection that was accepted is less than Maintenance Level C . . ." for the areas of wet weather overflows such as China Basin Channel./3/ Maintenance Level C is the lowest maintenance level which applies to "areas where water quality or aquatic productivity may be limited due to the pollution effects of a dense human population or other urban activities which are largely uncontrollable. Such areas may include some shipyard and harbor areas."/4/

Beneficial Uses - Central San Francisco Bay/2/

Some of the beneficial uses defined by the Basin Plan for Central San Francisco Bay are not found in China Basin Channel, but may exist in adjacent waters. The Water Quality Control Plan recommends that water quality in the channel be improved to and maintained at a level that will allow any of the following beneficial uses defined for the area even if such uses currently do not occur there:

- Industrial process supply - Includes process (cooling) water supply and all uses related to the manufacturing of products;
- Navigation - Includes commercial and naval shipping;
- Water contact recreation - Includes all recreational uses involving actual body contact with water, such as swimming, wading, etc., where ingestion of water is reasonably possible;
- Non-water contact recreation - Recreational uses that involve the presence of water but do not require contact with water, such as picnicking, sun bathing, pleasure boating, etc.
- Commercial and sport fishing - The commercial collection of various types of fish and shellfish, including those taken for bait purposes, and sport fishing in non-fresh water areas;
- Wildlife habitat - Provides a water supply and vegetative habitat for the maintenance of wildlife;
- Preservation of rare and endangered species - Provides an aquatic habitat necessary, at least in part, for the survival of certain species established as being rare and endangered species;
- Fish migration - Provides a migration route and temporary aquatic environment for anadromous or other fish species;
- Fish spawning - Provides a high-quality aquatic habitat especially suitable for fish spawning;
- Shellfish harvesting - The collection of shellfish such as clams, oysters, abalone, shrimp, crab and lobster for either commercial or sport purposes; and
- Estuarine habitat - Provides the habitat that serves to acclimate anadromous (seagoing freshwater) fishes during migration, and provides for the propagation and sustenance of a variety of fish and shellfish, numerous waterfowl, shore birds, and marine mammals.

Navigation and non-contact water activities, including boating, occur on the channel. Recreational fishing has been observed there, although it is not known if fish are consumed. Water contact recreation in the channel is minimal or non-existent. As discussed in VI.M. Vegetation and Wildlife, pp. VI.M.1-VI.M.6, the following beneficial uses occur at the site: wildlife habitat, preservation of the rare and endangered brown pelican, fish spawning and estuarine habitat. No waters are known to be directly extracted for industrial uses. No surface water or groundwater is used as a water supply for domestic or industrial purposes.

RUNOFF

Site Drainage Characteristics

Runoff is generated in the Project Area when rainfall runs off of impermeable surfaces such as rooftops and paved areas. Compacted soils on land that has been used for parking, railroad, and industrial uses generate substantial runoff. Runoff from most of the Project Area is collected in the storm drains connected to the City's combined sanitary sewage/stormwater collection system. The system is described in VI.D. Community Services and Infrastructure, Sewers and Wastewater Treatment, p. VI.D.24. In the area of China Basin Channel, stormwater from north of the channel is collected in a large (18 feet by 18 feet) sewer along the Embarcadero and Berry Street. Flows from south of the channel are collected in a storage sewer along the south edge of the channel before being pumped to the Southeast Water Pollution Control Plant. During major storms, the storage capacity of the sewers is exceeded and combined flows of sewage and stormwater overflow into the channel. The overflows are discussed below under China Basin Channel.

In some unpaved areas rainwater can soak into the soil and reach groundwater. Portions of Mission Bay near the channel and Bay drain directly into those waterbodies rather than into the stormwater collection system.

The peak quantity of runoff from the Project Area under existing conditions has been estimated by use of the Rational Method to be about 436 cubic feet per second (cfs) during a five-year storm./5/ This methodology is described in Appendix J. Hydrology and Water Quality, p. XIV.J.3, and the results of the analysis are summarized in Table XIV.J.2, p. VI.J.4.

Runoff Quality

The combined stormwater/sewer system carries wastewater and runoff from areas throughout the City, including the Project Area, which is largely industrial. Many industries in the Project Area use, handle and store chemicals, and generate a variety of chemical wastes or by-products (see VI.N. Hazardous Wastes, p. VI.N.14). Deposition of chemicals (solvents, fuels, waste materials) through accidental spills or storage and disposal may result in contamination of soils, groundwater, and surface runoff. Petroleum products are of concern, especially during fueling operations. Intentional and illegal dumping of chemicals also undoubtedly has occurred. The low nighttime population of the area may attract "midnight dumping" by unknown persons of materials into the stormdrain intakes and gutters. Materials also may leak into ground and surface waters from drain and sewer collection systems.

Street surfaces are collection areas for pollutants which contaminate runoff and receiving waters. Local soil erosion and motor vehicle emissions and use deposit pollutants on street surfaces. Most of these materials are probably carried by surface runoff to the storm drains.

FLOODING

- The 100-year high tide (the height which is equalled or exceeded with an average frequency of once every 100 years) would reach an elevation of about -2.0 feet San Francisco Datum (SFD) (see note/4/ in VI.K. Geology and Seismicity, p. VI.K.57, for definition). The elevation of the Project Area ranges from +6.0 to -2.0 feet SFD. As a result, portions of the Project Area would be subject to inundation from flooding from the 100-year high tide.

GROUNDWATER

Most of the Project Area is underlain by heterogenous fills of highly variable character and permeability. Thicknesses range up to 57 feet, and average 18 feet. Fills resting on Bay Mud vary considerably and range from clean sands to rubble and materials which may be contaminated with hazardous substances./6/ Geology of the Project Area is discussed in VI.K. Geology and Seismicity, p. VI.K.2; Hazardous wastes are discussed in VI.N. Hazardous Wastes, beginning on p. VI.N.5.

Depth to groundwater, measured in borings in 1983, ranged from 3.5 feet to 9 feet below the ground surface. In general, the groundwater table elevation coincides with the mean water level, or mean sea level, in adjacent San Francisco Bay./6/ Testing of water samples from seven water quality monitoring wells located throughout the Project Area west of Third Street indicated that the groundwater is brackish (water with a salinity between that of non-saline freshwater and sea water) and appeared to be contaminated with sewage. The brackish nature of the groundwater could be a result of intrusion of San Francisco Bay water into the freshwater./7/ While coliform counts were far in excess of standards for municipal water supplies, there are no uses of groundwater at Mission Bay. Groundwater in the Project Area likely contains trace amounts of some hazardous materials deposited on the surface or in the soil over the past 125 years by industries operating in and adjacent to the Project Area. Although groundwater in the Project Area has not been tested yet for such materials, hazardous toxics (those that will dissolve in water) could have moved down through the fill with rainfall, percolating to groundwaters. Materials recently carried by runoff from the general vicinity and deposited in the China Basin Channel (see discussion on p. VI.L.10) are a good indication of the extent and nature of surface contamination in the Project Area; analysis of those materials shows widespread metal, petroleum product, and chemical contamination. The water samples were not tested for hazardous materials.

Underground storage tanks are potential sources for contaminant release into surrounding soils and groundwater. Aging or improperly designed and maintained tanks may release their contents to the subsurface environment, and generally do so undetected. The degree of contamination depends on several factors including pollutant characteristics, soil type and thickness, depth to groundwater, and hydrologic characteristics of the site.

UNDERGROUND STORAGE TANKS

Forty-nine underground storage tanks are known to have been installed within the Project Area in the past; due to an on-going tank removal program by landowners within the Project Area, about 13 of these tanks have been either abandoned in place or removed as of June 1988. Many of the tanks were or are used to store gasoline (about 14) or diesel fuel (about 18), but the contents of many tanks (about 17) are unknown. The typical tank in the Project Area has a capacity of 5,000 gallons and has been in place for over 15 years./8/ An unknown member of unlisted tanks also may be in the Project Area.

CHINA BASIN CHANNEL

Hydrology

China Basin Channel is tidal and extends northeast from near Seventh Street to China Basin, between Pier 46 and Pier 48. The channel parallels Berry Street and is approximately 5,300 feet long and 200 feet wide. The bottom of the channel ranges in elevation from approximately -11.6 feet San Francisco Datum (SFD) at its southwest end to a depth of -38.6 feet SFD at China Basin. The average bottom elevation of the channel ranges from approximately -21.6 feet SFD in the southwestern half to about -31.6 feet SFD in the northeastern half. The tidal range within the channel is approximately 6.3 feet, with mean lower low water (MLLW) at -11.6 feet SFD and mean higher high water (MHHW) at -5.3 feet SFD./9,10/ The mean tidal prism (the volume of water moved in and out during a mean tidal cycle) is large compared to the total volume of the channel, providing good tidal circulation at the China Basin end of the channel, even though the channel is a dead-end and the west end is shallow. Another factor promoting water circulation is that the channel discharges into San Francisco Bay at a location where tidal currents are strong. Tidally induced circulation is reduced during neap tides (tides of lowest range) because tidal flushing is then weakest. Conversely, tidal flushing is most effective during the spring tide period (tides of highest range). At present, the channel is shallow; since dredging is not now employed, it will eventually develop into mudflats, impeding outflow from the sewer outfalls./9/ Sedimentation rates of approximately six inches per year occur in the channel where the bottom is lower in elevation than about -22 feet SFD. As channel depth decreases, the sedimentation rate apparently decreases to about three inches per year.

Water Quality

Little water quality information for China Basin Channel is available, but a general assessment done for the Bayside Overflow Study indicates that the upper end of the channel has low dissolved oxygen levels, pH ranging from 7 to 8 (neutral to slightly basic), and total coliform counts of 200 to 500 MPN per 100 ml (most probable number per 100 milliliters)./11/ Coliform bacteria are bacteria found in soils and in the intestinal tract of warm-blooded animals; they are used as a standard indicator of potential sewage contamination. Water quality standards for coliform have been established by the RWQCB for water contact recreation as having a median value of less than 240 per 100 ml with no sample to exceed 10,000 per 100 ml.

Sewage/Stormwater Overflows

The combined stormwater/sewer system collects both stormwater runoff and municipal wastewater sewage. It is operated by the Clean Water Program (see VI.D. Community Services and Infrastructure, Sewers and Wastewater Treatment, p. VI.D.24). When collection and treatment systems are overloaded, as during heavy rains, untreated wastewater overflows into the channel at six outfall structures along the channel as well as the outfall of the Division Street Sewer at the southwest end of the channel. The Master Plan developed by the City and County of San Francisco to treat its wastewater, as accepted by the San Francisco Bay Regional Water Quality Control Board (RWQCB), allows for some overflows of minimally treated wastewater during wet weather.

Clearly, these overflows affect the water quality of the channel. However, at present, the level and type of water pollution within the channel have not been defined, although the Clean Water Program conducts some tests of the overflow waters being discharged to the channel. Runoff from the Project Area also may add pollutants directly to the channel. Available information does not allow an assessment of relative contributions to the contaminants found in the channel from groundwater, surface runoff, and/or overflows. Water entering the channel from the bay probably contributes relatively little to the contaminant load, although the effect of its salinity promotes precipitation of clay particles in the channel with any adsorbed pollutants.

Sampling of Overflows

Composite water samples were collected in 1979 at overflow structures during overflow events to characterize combined sewer overflows./11/ Those data are described in more detail in Appendix J. Hydrology and Water Quality, p. XIV.J.5. Constituents in combined sewer overflows include bacteria, suspended solids and ammonia found in sanitary sewage, but generally at lower concentrations because of dilution by stormwater. Concentrations in the overflows varied widely for most constituents./11/ The Clean Water Program currently samples the composition of the overflows for settleable solids, pH, total suspended solids, grease and oil, conductivity, and biochemical oxygen demand as well as bacteria, and ammonia. The overflow sampling points are located along the channel in the Fifth Street and the Sixth Street structures. Appendix J. Tables XIV.J.3, XIV.J.4, and XIV.J.5, p. XIV.J.9-XIV.J.11, give data from 1987 sampling of the overflows. Constituents found in the overflow water are generally lower in concentration than those found in untreated domestic wastewater, but exceed standards for municipal use, water contact recreation and shellfish harvesting./12/ Water quality measurements, objectives, and standards are discussed in the following paragraphs.

Impacts of Overflows on Water Quality

Detailed discussion of the impacts of overflows on the water quality of China Basin Channel are given in Appendix L. p. XIV.L.6. A summary of that discussion is given below.

Sewage / stormwater overflow discharges typically occur during winter and spring. During storm periods of high runoff, large overflow discharges can occur that fill the channel before tidal action can dilute and disperse them. A typical maximum annual discharge event is on the order of 200 to 300 acre-feet. The San Francisco Clean Water Program reported 15 overflow events in the channel during the 1985-1986 wet weather period. With improvements now being completed, the City estimates that discharges will be reduced to a frequency of about 10 per year./9,12/

When storm-induced sewer discharges occur, pollutants in the sanitary sewage are diluted by stormwater. In addition, large discharges generally occur during the low sun period when water temperatures and solar radiation are low and dissolved oxygen levels are high. Little biological activity is occurring in the channel during that time of the year, so biochemical consumption of dissolved oxygen is reduced.

Pollutants in the overflows can be dispersed in the channel by tidal action as well as flows induced by water density stratification. The latter process results because of the marked differences in salinity of the overflow discharge and saltwater. The freshwater of the overflow has approximately 1% of the salinity of the Bay water and, therefore, a lower density. During overflows, the sewage/stormwater discharge flows on top of the channel's saltwater with only partial mixing. This flow of the top water induces a counter current in the deeper Bay water; the net water movement can be many times greater than the overflow discharge rate itself. This overall water movement, then, accelerates flushing of pollutants out of the channel./9/

Continuous dye release at the Division Street overflow in 1979 revealed a 10:1 dilution ratio by the time the dye reached the Third Street Bridge. Approximately 11 hours after the dye release ended, dilutions within the channel were 100:1. The dye dilution profiles indicate that the waste-field stays within the top three feet under these conditions./9,11/ Sampling in the channel during and following overflows found that salinity gradients generally return to normal within about 24 hours./9/

The most serious water quality problems can develop when the density stratification is destroyed and the channel becomes completely mixed. This could occur if the discharge were appreciably colder than the salt water, increasing the density of the overflow waters (and causing them to sink and mix with the channel saltwater); if the salt water were already diluted by flood flows, so that its density were decreased; or if wave and current actions were to mix the water physically./9/

Concentrations of coliform bacteria also increased in the channel when overflows occurred. The coliform bacteria concentrations in the channel during overflows, which were on the order of 1 multiplied by 10^6 MPN per 100 ML, were diluted by about 10:1 at the end of the pier line at the Bay. After overflow events, bacteria concentrations decreased quickly. Channel concentrations of coliform were reduced by 90% in about 24 hours./11/

Generally, dissolved oxygen concentrations were only slightly affected by overflow events. Background dissolved oxygen concentrations were found to be normal (generally assumed to be no less than 5 mg/l, the RWQCB standard), according to the Bayside overflows study, at a sampling station near the Third Street Bridge, indicating that the low dissolved oxygen content which was found in the channel may exist only near the shallow end of the channel. The generally low dissolved oxygen concentrations in the shallow end of the channel are probably related to oxidation of solids which settle from the overflows to the channel bottom.

Ammonia as nitrogen values ranged from 0.94 to 8.37 mg/l with an annual mean of 2.09 mg/l for the 1985-86 season. The mean for 1986-87 was 4.64 mg/l, with values ranging from 0.59 to 17.3 mg/l./12/ RWQCB objectives for ammonia are 0.025 mg/l as an annual median, with the maximum at any one time not to exceed 0.16 mg/l.

The RWQCB does not set objectives for concentrations of heavy metals (such as chromium, lead, mercury, nickel, zinc) for surface waters which are not used for municipal supply or agriculture. However, there are toxic material effluent limitations for the sewers which discharge to inland surface waters. During overflow events in

January through March 1987, the limits for chromium (daily maximum limit 0.01 mg/l was exceeded twice. Nickel (daily maximum limit 0.2 mg/l) and silver (daily maximum limit 0.04 mg/l) limits were exceeded once each./12/ None of the heavy metal concentrations tested is above its Soluble Threshold Limit Concentration for hazardous waste./13/

Impacts of Overflows on Sediment Quality

The bottom sediments of China Basin Channel were assessed in a 1979 study./11/ Results of bulk sediment analyses of the upper six inches of sediment are given in Appendix J. Hydrology and Water Quality, Table XIV.J.6, p. XIV.J.12. Test results indicated that the combined sewage/stormwater overflows are potentially significant point sources for the introduction of metals, oil and grease, sulfides, chlorinated hydrocarbons, and petroleum products (hydrocarbons) to the sediments of the channel. Comparing sediment constituent values for the sample locations in the channel, an increase in metals, organic carbon, oil and grease, sulfides, and chlorinated hydrocarbons is evident at locations closer to the overflow structure at the head of the channel. Levels of cadmium, copper, zinc, mercury, organic carbon, sulfide, and Aroclor (a brand name for a PCB product) are all far above background levels; chromium, silver, arsenic, and nickel are also present in concentrations above background levels./9/ While levels of these materials do not exceed any current standards, lead, DDD, and DDT concentrations may exceed the state's Total Threshold Limit Concentration (TTLC) values for hazardous wastes./14/ Water movement induced primarily by tidal flushing is important in dispersing and removing contaminants from the channel; however the relatively impeded circulation at the upper end of the channel has limited capability to do so./9/

Ongoing Water Quality Sampling

In addition to the sampling program conducted on overflow events, the San Francisco Clean Water Program conducts ongoing monitoring of the waters in China Basin Channel at three stations located at the northeast corner of the Third Street Bridge, near the Fifth Street overflow structure, and near the Seventh Street overflow structure. Currently, the channel is sampled weekly for total coliform bacteria; ammonia is measured once per month during dry weather and up to twice per month during wet weather. Temperature, dissolved oxygen, conductivity and pH are generally sampled twice per month./15/ Water quality data are summarized in Appendix J. Hydrology and Water Quality, Table XIV.J.5, p. XIV.J.11.

The data reveal occasional violations of the state water quality objective for dissolved oxygen set at five milligrams per liter (mg/l). The data are not reported in a form which allows detailed determination of conformance with bacteria standards; however, the measured values indicate that, including both wet and dry periods, the water contained greater than 1,000 MPN total coliform/100 ml at least 19% of the time. This value is far in excess of the standards for water contact recreation, shellfish harvesting, and municipal supply. Ammonia values ranging from 0.04 to 1.1 mg/l have been measured in the channel; the source of this ammonia is not known./16/ The RWQCB objective for ammonia is 0.025 mg/l annual median; the maximum at any one time is 0.16 mg/l.

Houseboats

Houseboats berthed in China Basin Channel are a potential source of water pollution. The houseboats on the south side of the channel are served by the local sewer system; those on the north side are not. There is potential for some direct discharge of pollutants into the Channel through accidental spills or actions such as washing of decks, although the source is likely to be small.

Sediment Characteristics in the Channel

The sediment in the channel is composed of settleable solids derived from combined sewage overflows and the settling of materials suspended in waters entering the channel from the Bay. The bottom sediment particle size distribution data are presented in Appendix J. Hydrology and Water Quality, Table XIV.J.5, p. XIV.J.11, as the percentage of sand, silt, and clay. Reduced physical velocities and currents within China Basin Channel, as compared to the Bay, allow the settling of all particles, as indicated by the large fraction of silt and clay sediments at the Third and Fourth Street sample sites. The variability in particle size distributions from the different samples taken at each station is important to changes in sediment chemistry parameters over time. Fine-grained sediments like silt and clay readily can adsorb materials, such as silver, cadmium, copper, iron, lead, selenium, zinc, oil and grease, and chlorinated hydrocarbons, as is shown in the sediment analysis in Appendix J., Table XIV.J.6, p. XIV.J.12. When these materials are adsorbed onto the suspended sediments, they subsequently settle into the bottom mud and become trapped within the channel, rather than being dispersed and diluted in the water. Sediment testing generally reveals that 1979 China Basin Channel sediments contained higher levels of inorganics than other location of the Bay studied in the past three years (see Table XIV.J.6, p. XIV.J.12). The presence of these materials in sediments indicates water conditions which are not conducive to healthy aquatic biological communities (see VI.M. Vegetation and Wildlife, p. VI.M.4).

IMPACT

This section discusses the impacts to hydrology and water quality which could result from development of the Alternatives. Construction impacts are described first. It is important to note that they should not be considered temporary impacts because there likely would be construction occurring over a 30-year period, although the intensity of activity would vary over time. Following the discussion of construction impacts, there are explanations of impacts relevant to surface runoff, flooding, groundwater, China Basin Channel, and development of wetlands. In each case, hydrologic and water quality issues at build-out (in the year 2020) are discussed. Following the general discussion which covers impacts of all alternatives, specific details appropriate to each alternative are described.

CONSTRUCTION

Most of the site is flat, with low erosion potential in its undisturbed state. However, site clearance and cut and fill operations would expose large areas of the Project Area to erosion. Sheet erosion would occur on the flat areas. In the short-term, that could increase suspended solids concentrations in the sewer system, channel, and Bay. Erosion could result in conflicts with San Francisco Bay Regional Water Quality Control Board (RWQCB) criteria for suspended material, settleable material, sediment, turbidity, and toxicity. The criteria for constituents are listed in Appendix J. Hydrology and Water Quality, Table XIV.J.1, p. XIV.J.1.

Construction activity, including truck and heavy equipment traffic, tends to spread soil onto surrounding roads and walkways. Much of this material would be washed into storm drains during rain storms or if water were used to wash down the vicinity of building sites. More seriously, erosion could occur were soil stored on the site in piles or if surcharges were used. The magnitude of soil losses from a site being surcharged or used for soil storage would depend primarily on the area covered by the soil; slope of the soil; soil characteristics such as grain size, compaction, and surface texture; kind of vegetative cover; nature of erosion control measures; and amount and intensity of rainfall during its storage period. Applying the Universal Soil Loss Equation to the Project Area, one can calculate that during an average rainfall year, piles of sandy soil 20 feet tall would lose soil at a rate of approximately 130 tons of soil/acre annually./17/ Such storage piles probably would not cover large areas, but soil losses would be large if erosion control measures were not taken. Similar calculations for the sloped edges of surcharge piles five feet thick indicate that soil losses would be 110 tons/acre annually./17/ Total soil loss by Alternative cannot reliably be calculated because detailed grading plans are not available; these soil loss rates should not be applied on an annual basis to the Project Area as a whole. They apply only to the areas covered by storage piles or sloping sides of surcharges which would exist only for periods of one to, perhaps, three years.

Furthermore, because of past industrial activity in the Project Area, some of the soil in the Project Area contains elevated concentrations of contaminants. Erosion of that material could result in contaminated sediments in the sewer system, channel, and Bay. The Project Area may also contain undiscovered underground storage tanks, or other buried containers of liquid hazardous materials. If containers, some of which could be corroded or otherwise structurally unsound, were ruptured during excavation or removal, hazardous materials could be released to the soil and gradually enter the groundwater. This could also result in conflicts with RWQCB criteria for toxicity.

The Project Area is subject to the Hazardous Site Investigation Ordinance, which would require that the Project Area be investigated for hazardous wastes.

Alternative A

The total acreage cleared during development would be about 240 acres. During the initial phase of development, about 15 acres would be cleared.

Alternative B

The total acreage cleared during project development would be about 240 acres. The initial phase would include clearing about 14 acres for construction.

Alternative N

The total acreage cleared during development would be approximately 200 acres.

New development under Alternative N is expected to occur primarily in the area north of the channel and in the area south of the channel west of Third Street. The area south of the channel, east of Third Street, is expected to have less new development; thus, less grading would be required and, consequently, lesser short-term erosion impacts would be expected than under the other alternatives. As a result, water quality impacts related to sediments would be less than those under other Alternatives.

SURFACE RUNOFF

Runoff Amounts and Quality

Peak runoff would not change significantly under Mission Bay Alternatives (see Table VI.L.1). Following development, runoff would be collected in the San Francisco combined sanitary and stormwater sewer system. More specific features of the collection system are discussed in VI.D. Community Services and Infrastructure, Sewers and Wastewater Treatment, p. VI.D.24. The general pattern of runoff would not be altered significantly but the layout of the pipeline system would change. The San Francisco Clean Water Program has indicated that runoff expected by 2020 could be accommodated by the system without major changes to it./18/

New development would result in the elimination of existing pollution-generating activities in the Project Area. Existing and past industrial practices, parking, truck traffic, impound and other car storage sites and railroad activities, and other uses probably generate or have generated pollutants under existing or past conditions. To the extent that those sources of pollution would be removed and not replaced by other similar sources, an improvement in surface runoff water quality may be expected. Overall, it is not possible to draw specific conclusions on the comparative quality of runoff expected after development because of the conceptual nature of the many land uses that could occupy the Project Area and the general lack of precision in predicting the amounts, quality and concentration of nonpoint source runoff.

Most runoff from the Project Area would be generated by impervious surfaces such as roofs and paving. Runoff quality is expected to be similar to runoff from other areas of the City since land uses would include industrial, commercial, and residential uses. The land use of the area would be altered from existing industrial and railroad use to a mixture of residential, commercial and light industrial uses for Alternatives A and B. The pollutants in the runoff would generally be those generated by automobile traffic and local home and business occupants. The increased traffic in the area which would

TABLE VI.L.1: RUNOFF TO STORM DRAINS GENERATED BY ALTERNATIVES, 1985 AND BUILD-OUT/2020/a,b,c/

Land Use	C /d/	1985		Alt. A		Alt. B		Alt. N	
		(ac)	(cfs)	Area (ac)	Runoff (cfs)	Area (ac)	Runoff (cfs)	Area (ac)	Runoff (cfs)
Office/Commercial/ Retail	0.9	NA	NA	39.2	62.5	13.2	25.8	6.9	10.9
S/LI/RD	0.8	NA	NA	50.2	82.8	6.0	10.2	NA	NA
Port-Related	0.9	NA	NA	6.5	13.3	NA	NA	NA	NA
M-2 Industrial	0.7	NA	NA	NA	NA	NA	NA	127.3	189.1
Port-Related/M-2	0.7	NA	NA	NA	NA	NA	NA	65.5	102.9
Existing Industrial	0.9	123.3	248.3						
Residential									
LDR	0.7	NA	NA	6.4	10.2	18.4	29.2	NA	NA
MDR, MHDR, and HDR	0.8	NA	NA	82.1	144.0	109.7	179.0	NA	NA
Community Facilities	0.8	0.6	1.1	2.4	4.4	5.6	9.9	0.8	1.5
Open Space									
Parkland	0.25	NA	NA	43.3	23.9	48.3	25.5	0.8	1.5
Wetland	0.25	NA	NA	NA	NA	33.8	NA	NA	NA
Gravel/Dirt	0.25	73.9	46.3	NA	NA	NA	NA	NA	NA
Rail (unpaved)	0.3	44.8	26.3	5.3	2.9	3.9	2.5	34.1	17.6
Freeway/Streets/ Rail (Paved)/ Parking/e/	0.9	66.8	114.0	77.1	136.7	73.6	131.0	72.7	136.3
TOTAL		309.4	436.0	312.5	480.7	312.5	413.1	308.1	459.8

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ac - acre; cfs - cubic feet/second; NA - not applicable.

/a/ Area does not include 1.6 acres occupied by the Pumping Station or 15 acres occupied by the channel. The total area of 326 acres was used to conform with the area used by the City Clean Water Program in its estimates for runoff from the Mission Bay area.

/b/ The runoff for each Alternative is the total of the runoff generated in watershed sub-areas, each of which has a different design storm; therefore, runoff is not directly proportional to area. See Appendix J. Hydrology and Water Quality, p. XIV.J.3, for more information.

(Continued)

TABLE VI.L.1: RUNOFF TO STORM DRAINS GENERATED BY ALTERNATIVES /a,b,c/ (continued) •

/c/ The areas on this table for various land use categories are not the same as those in Table V.2, p. V.9, because some areas generate runoff which flows directly into the Bay or the channel without entering the storm drains.

/d/ C = Coefficient of runoff. Coefficients were obtained from City Subdivision Regulations, the Clean Water Program, and "Desk-Top Methods for Urban Stormwater Calculation" by David Kibler in Urban Stormwater Hydrology. See Appendix J. Hydrology and Water Quality, p. XIV.J.3.

/e/ Includes freeways which are elevated above other stated uses, such as railroad.

SOURCE: Environmental Science Associates, Inc.

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accompany the changed use of the area would generate more pollutants such as oil, grease, and tire and exhaust residue. The local resident and employee population would generate litter and other debris. Landscaped open space would include the use of fertilizers, pesticides and herbicides. Pollutants that would be generated by future industrial uses are not known because specific uses are not defined, although heavy industrial uses would not be developed. The potential would exist for spills of unknown composition and discharges of pollutants in wastes that flow into the sewer system. Some of these could include toxic and hazardous materials.

Except during overflow events, about 80% of the stormwater collected at the Southeast Water Pollution Control Plant receives secondary treatment (85% to 90% of particulates removed) and 20% receives primary treatment (50% of the particulates removed)./19/ About 90% of the metals and most of the organic hydrocarbons show a strong affinity for the particulates. Therefore, when the particulates are removed during treatment, the attached metals and hydrocarbons are removed. This means that at least 10% to 15% of the contaminants are likely to remain in the water after secondary treatment and more than 50% after primary treatment./19/

Runoff would be discharged into the stormwater/sanitary sewer system and would be mixed with runoff from other areas of the system before being transported to the Southeast Water Pollution Control Plant for treatment (or discharged untreated to the channel during an overflow event). Therefore, any change in quality of the runoff from the Project Area reaching the Bay would be expected to occur under circumstances of an accidental spill of hazardous materials or during overflow events.

Although subject to regulation and enforcement of the RWQCB, new industrial or research and development users of the property might discharge certain unauthorized chemical compounds into the sewer system. This is discussed in VI.D. Community Services and Infrastructure, Sewers and Wastewater Treatment, p. VI.D.105. During storm events, pollutants from those unauthorized discharges could flow directly into the channel and the Bay. The pollutants would be diluted with stormwater, but could add to overall pollutant loadings to the Bay.

Table VI.L.1 summarizes the expected runoff at build-out from the Project Area under each Alternative. The methodology used for this analysis is discussed in Appendix J. Hydrology and Water Quality, p. XIV.J.3.

Alternative A

Runoff under Alternative A is estimated to be about 480 cubic feet per second (cfs) at full build-out/2020 using worst-case assumptions of ground cover by impervious surface. This is about 10% greater than runoff from the Project Area under existing conditions. The Clean Water Program has indicated that the existing sewer system can accommodate the increased runoff; however it will review specific plans, generally, south of the channel and south of 16th Street, to determine that the actual expected runoff could be accommodated./18/

Alternative B

Runoff under Alternative B at full build-out is estimated to be about 413 cfs under worst-case assumptions for runoff generation, that is, about 95% of existing peak runoff and less than that under Alternative A. The larger amount of open space in Alternative B accounts for most of the difference because open space allows more water to infiltrate into the soil than impervious areas that generate more runoff flowing into the sewer. The runoff could be accommodated by the existing system. Runoff quality would be similar to that described for Alternative A. Pesticides, herbicides and fertilizers may be of higher concentrations under this Alternative because of the larger area of parkland.

Alternative N

Estimation of runoff generation under Alternative N is more difficult than for the other Alternatives because development plans are less specific. Under most-conservative assumptions (that is, that runoff from all of the area would be collected in the sewer system and that most of the area would be paved) runoff is estimated to be about 460 cfs. That also assumes that some areas that are now impervious will remain so. That is about 6% more than the existing setting.

Alternative N would result in larger numbers of industrial users and a greater potential for the future use of hazardous materials.

FLOODING

- If structures or roadways were placed at elevations at or below -2.0 feet SFD, after settling on the site, they could be subject to tidal flooding during the 100-year event. As the elevation of portions of the Project Area is below -2.0 SFD, certain areas would be subject to flooding if there are no mitigating factors incorporated into the construction design./20/

- If sea levels were to rise, flooding would occur more frequently. Changes in sea level have been constant and gradual over the past 5,000 years. Recent studies by the Environmental Protection Agency (EPA), however, indicate that a global warming trend will lead to an acceleration in the rise of sea levels worldwide. According to a report prepared by the San Francisco Bay Conservation and Development Commission, the mean sea level at the Presidio would rise 0.43 foot (5.16 inches) by the year 2006, and 0.65 foot (7.8 inches) by the year 2036./20a/

- Provisions for higher groundwater levels can be accommodated at Mission Bay in the design stage for structures and infrastructure. Higher water levels would result in more flushing of the channel but would not otherwise cause hydrological complications. Clearances for boats would be reduced at the two existing bridges, but deeper water and more flushing would reduce the need for dredging to clear the channel for navigation. Seiche run-up is discussed in Volume Four, XV.I. Geology and Seismicity, pp. XV.I.14-XV.I.15.

GROUNDWATER

Groundwater Levels

Groundwater levels in the Project Area may be expected to occur between depths of three to nine feet below the ground surface./6/ Dewatering could be required to make excavation possible. Dewatering could also be required in conjunction with cleanup of hazardous waste contamination of groundwater, although extraction and reinjection is more likely than dewatering. The degree of dewatering needed for cleanup of contaminated groundwater, if any, is unknown. Dewatering would stimulate additional saltwater intrusion into the dewatered areas as salt water flowed in to replace the water that was pumped out. The net effect, however, could be improved water quality if the hazardous wastes were found and removed. Dewatering is discussed in VI.K. Geology and Seismicity, p. VI.K.30.

Groundwater Quality

Underground storage tanks for various chemical compounds, including potentially toxic substances, exist or have existed at the site. Buried drums containing liquid hazardous materials could remain in the Project Area. Past industrial uses of the site and filling with contaminated soils or hazardous wastes could have contaminated some of the soil in the Project Area. If underground structures have leaked or are leaking, contaminants have already been introduced into the groundwater. Of the four general types of hazardous wastes (reactive, ignitable, corrosive, and toxic), materials that are exclusively reactive, ignitable, or corrosive would not be expected to be present in groundwater; their non-toxic hazardous properties would be neutralized by ambient (buffered and lacking oxygen) brackish-water conditions. Some hazardous materials in the toxic group, however, could have entered the groundwater as toxic pollutants. Metal ions, petroleum products, and chlorinated hydrocarbons are present in the sediments of China Basin Channel, and may be widespread pollutants in groundwater in the Project Area. Removal of leaking tanks, buried drums, and contaminated soils as part of project construction could improve groundwater quality. Because underground storage tanks and drums could be corroded and in poor structural conditions, however, removal also poses the risk of additional contamination from ruptured containers.

Following development, further degradation of groundwater quality probably would be reduced, although the magnitude of any improvement would depend on the extent of existing pollution, the exact nature of any new potential pollution sources and the control measures adopted as part of the project to reduce the potential for groundwater pollution. Industrial users of the site could employ a variety of chemicals in process and research and design work, ranging from metals and organics to radioactive substances. The major potential source of groundwater contamination would be storage of potentially polluting materials in underground storage tanks that might later leak. Newer tanks, and regulations being developed by the state and the EPA, would limit the leakage potential. There is no proposal for use of groundwater at the site. Contaminated groundwater would pose a hazard if the public and/or terrestrial and aquatic wildlife were exposed to contaminated groundwater. This could occur in a variety of ways, such as excavation to the water table, pooling of groundwater at the surface, seepage into below grade structures, or seepage into wetlands, parks, and the Bay.

Spills would be another pathway for groundwater contamination. Spills could occur during construction or from future industrial activity in the Project Area. Additional development on the Project Area would increase the amount of impervious surface in some portions of the site. In these areas, spills would not be expected to affect groundwater quality. It is not possible to predict the number or type of spills that could occur due to variations in the types of industries present, methods used for disposal of contaminants, and routes used to transport chemicals.

Infiltration of stormwater runoff or irrigation water can degrade groundwater quality. Because much of the site would be covered with impervious material and subject to minimal infiltration, this would not be a major cause of degradation. However, additional nutrients and pesticides or herbicides could be introduced to the groundwater beneath landscaped areas by infiltration of rainfall and irrigation water into the soil column. Whether this would represent a measurable change would depend on the existing conditions, the type of vegetation and the rate of application of such substances.

The groundwater at the site has been found to be brackish. The high salt content could cause accelerated corrosion of metal pipes and underground storage tanks. Corrosion could lead to leaks or failures in these pipes and resulting water quality degradation. Failure also means that the pipes must be replaced more frequently, increasing maintenance costs.

Alternative A

Alternative A would not be expected to have long-term effects on the overall water table elevation or the movement of groundwater because the groundwater level is largely a function of mean sea level. Infiltration would decrease under Alternative A, but the effects on groundwater probably would be insignificant. Dewatering during construction could temporarily lower groundwater levels locally.

Alternative B

The development of wetlands under Alternative B could affect local groundwater levels in the immediate vicinity by creating a direct connection between shallow groundwater and the channel. Depending on the relative elevation of wetland water level and groundwater table and the rate at which water moves in the soil, recharge or drainage of groundwater could occur. The larger area of parkland also would allow more infiltration of rainwater into the soil. These would be minor effects since the groundwater level, channel, and wetland would all be, on average, at mean sea level. No widespread change in groundwater levels would be expected because these levels are controlled by Bay water levels.

Construction of new wetlands might allow additional saltwater intrusion because the wetlands would be located farther inland than the existing channel or bay margin. However, this would depend on the actual flow patterns at the site (that is, the movement of fresh water toward the Bay and saltwater inland). This would be expected to be a minor impact because the larger area-wide groundwater flow regime would not be altered substantially by wetland development. Other groundwater impacts would be the same as those for Alternative A.

Alternative N

Impacts on groundwater would be similar to those expected under Alternative A.

CHINA BASIN CHANNEL

Water Quality

As discussed on p. VI.L.6, the water quality in China Basin Channel depends on the overall hydraulics of the channel, the frequency of stormwater overflow events and the volume of overflows. Adequate data to evaluate the causes and extent of existing water quality degradation in the channel do not exist. Recent improvements in the sewer and stormwater management system are designed to limit overflows to ten per year; that would have a presumed beneficial effect on channel water quality but of an unknown magnitude. During the year from June 1985 to June 1986, there were 15 overflow events for a total of 98 hours./21/ The summary for 1986-87 operation of the North Shore and Channel Street Systems does not show the number of overflow events, but the Channel Street system overflowed for a total of 67 hours./22/ Analysis of water samples taken at five locations along the length of the channel indicates that coliform counts are high in channel water whenever an overflow event occurs. Dissolved oxygen measurements during both years were low at the west end of China Basin Channel. Composite samples taken during overflow events into China Basin Channel at Fifth and at Sixth Streets were analyzed for ammonia, biochemical oxygen demand, and total suspended solids. All were at levels which would be expected from primary treated sewage./12/

The overflow effects on water quality pose varying levels of constraint on the Alternatives. The adverse water quality conditions pose a minimal constraint to development of Alternative A since the channel serves primarily as a visual/aesthetic amenity feature. The primary constraints probably would be related to odors and reduced aesthetic appeal. Additionally, there may be some increase in public health risk (see below); however, water contact recreation and fishing are not specifically integrated into the Alternative A development plans. The adverse water quality conditions pose the greatest constraint to Alternative B, because they could possibly affect the viability of the proposed wetlands and their wildlife (see discussion below). As with Alternative A, there may be an inadvertent increase in public health risk. The overflow-related water quality conditions pose no constraint to Alternative N.

It is not possible to evaluate precisely the overall impact Mission Bay could have on water quality in the channel. However, land uses surrounding the channel have less direct influence on the water quality of the channel than the combined sewer overflows and the tidal hydraulics of the system, at least for non-toxic pollutants. Changes in land use would not of themselves have a direct, major effect on the water quality. Peak runoff would be only slightly increased with Alternatives A and N, and decreased with Alternative B; thus, the number or intensity of overflows in the City-wide system would not be increased significantly by any of the Alternatives. The following sections discuss those aspects of development that could affect water quality and the implications of existing channel water quality for certain proposed elements of the Alternatives.

Alternative A

Hydrologic Characteristics. The basic hydrologic characteristics of China Basin Channel would not be changed under Alternative A, but the edge of the channel would be modified. The outfall area would remain as a soft, natural edge with gabions. The edge treatment in the rest of the channel would include T-walls, decking and gabions on the north side and decking and gabions on the south side./23/ Partial edge treatment along the channel would be completed in the initial phase of development. The T-walls and gabions could improve the stability of the banks and prevent bank erosion in the channel to varying degrees, depending on the detailed plans for the edge treatment. The effects of the edge treatment on habitat value are discussed in VI.M. Vegetation and Wildlife, p. VI.M.7.

Major dredging of the channel could affect the circulation patterns in the channel and, in turn, water quality, although this is not the reason for which dredging is proposed (see below). The amount of dredging proposed would not be large enough to cause any long-term significant changes in circulation in the channel.

- Water Quality Effects of Wet Dredging. Approximately 45,000 cubic yards of material would be wet-dredged from the channel in the initial phase of development under Alternative A./24/ Installation of T-walls to improve the appearance of the edges of the channel would require dry-dredging of an additional 85,000 cubic yards. The dredging plans have not been drawn; but it is likely that material would be removed from the north side of the channel near Fifth Street, where a mound of sediments has developed on the channel bottom. The dredging activity would last approximately two months. Additional maintenance dredging could be performed in the future; it is estimated by the project engineer that dredging would not occur more frequently than once in every ten years. Most dredging would be done from shore with a dragline but some could require the use of a dredge rig in the channel./24/ Dredging and disposal of dredge materials are considered one process. A permit is required, as discussed below under Regulation of Dredge Spoils Disposal.

In general, wet-dredging causes elevated concentrations of suspended sediments at the dredge site as well as at the disposal location (if land disposal is not used). In both areas, an increase in turbidity of the water occurs for a short period. The amount of increase depends on the environmental conditions, including currents and existing turbidity in the site vicinity, and the method used for dredging. The increased turbidity from dredging in the channel could result in short-term violations of the state water quality objective for turbidity and some disturbance of aquatic ecosystems (see VI.M Vegetation and Wildlife, p. VI.M.14). Generally, turbidity levels return to pre-dredging conditions within several hours following cessation of dredging activities./25/

The effects of dredging would not likely extend into the Bay unless the dredging were done at a time of high sewage overflows which would lower the salinity and increase the amount of water flowing into the Bay from the channel. The high salinity of Bay water causes fine particles to form clusters which act like larger particles. They settle more rapidly than the same material in fresh water. Larger particles disturbed by the dredging would settle rapidly within the channel because of their weight and shape; the salinity of the water would have little effect on their behavior.

Material to be dredged in China Basin Channel contains high concentrations of organic matter and sulfides which are subject to oxidation./11/ When dredge materials rich in these substances are added to the water column, the material is oxidized, causing an immediate drop in local dissolved oxygen concentrations./25/ This is a temporary consequence of dredging which could cause temporary violations of the state water quality objective for dissolved oxygen. The impacts of decreased oxygen levels and increased turbidity are discussed in Vegetation and Wildlife p. VI.M.15.

A major concern related to dredging and disposal of dredged material is the potential for toxic contaminants such as lead and chlorinated hydrocarbons in the sediments to be released to the water column during dredging and for their long-term release to the water column at the disposal site. The availability of chemicals associated with the sediments for long-term release to the water column depends on the nature of the bonds between the sediment and the chemical. Studies of the potential for release of pollutants from sediments during dredging and after disposal have determined that chemicals tend to remain in the sediments and are relatively unavailable for release to the water column. Thus, potential effects of dredge-spoil disposal on the plants and animals (see VI.M. Vegetation and Wildlife, p. VI.M.15) that live on or in the sediments, are of greater concern than the long-term effects on concentrations in the water column./25,26,27,28/ The sediments in China Basin Channel may be more polluted with inorganics (such as chromium, copper, lead, and silver) than sediments at other nearby locations in the Bay or at the Alcatraz disposal site and may contain higher levels of DDD and DDT than most other Bay sediments (see p. VI.L.11, and Appendix J. Table XIV.J.7, p. XIV.J.14).

In summary, temporary consequences of dredging could result in conflicts with San Francisco Bay Regional Water Quality Control Board criteria for odor, suspended material, settleable material, sediment, turbidity, dissolved oxygen, bacteria, and toxicity.

Regulation of Dredge Spoils Disposal. The U.S. Environmental Protection Agency (EPA) and Army Corps of Engineers (COE) regulate disposal of dredge spoils in the Bay and ocean. A three-tiered approach has been developed by EPA and COE to make permit decisions for dredge spoil disposal at an aquatic site; if not permitted for aquatic disposal, the spoils would be taken to a land disposal site. Tier 1 evaluation excludes certain materials from testing. Tiers 2 and 3 include sediment and biological tests. Under the proposed regulations, at a minimum, Tier 2 testing would be required for the sediments in China Basin Channel to determine the appropriate disposal location./26/ These detailed analyses have not yet been done because the regulatory agencies prefer that data for permits be recently collected. As it is not expected that permits for dredging would be requested for over one year from publication of the Draft EIR, testing done prior to the Draft EIR would be unacceptably old.

- Analysis of sediments from China Basin Channel under proposed Tier 2 standards would require determination of grain size and unit weight, total organic carbon, total and volatile solids, oil and grease, and total and water-soluble sulfides. Testing would also be done for various metals, pesticides, and other contaminants such as PCBs, phenols, and polynuclear aromatic hydrocarbons. A bivalve larvae assay would also be required. The characteristics of sediments in the channel would be compared with the same parameters at the proposed disposal site. If the dredging and disposal sites did not differ markedly, then aquatic disposal could take place. If there were a marked difference in the tested parameters between the dredging and disposal sites, Tier 3 testing, including bioassay and bioaccumulation testing, would be required. The Tier 3 testing program would be tailored to the specific disposal program and governed by the results of the analysis completed in Tier 2./26/ Based on preliminary assessments by KCA Engineers and CH_2M Hill, it is likely that wet dredge spoils from the channel would be contaminated with heavy metals and organics and would require special handling and disposal./29,30/ Special handling refers to treatments such as drying or containment of toxic wastes prior to disposal. If special handling were required, aquatic (bay or ocean) disposal would not be possible. Dredged material may require dewatering prior to removal from the Project Area to minimize the volume and reduce the possibility of leakage during transport.

- The Bay Conservation and Development Commission (BCDC) Bay Plan states the policy that:

> To prevent sedimentation resulting from dredging projects, mud from future dredging should be disposed of in one of the following ways: (a) placement on dry land, (b) placement as fill in approved fill projects, (c) barging or piping to suitable disposal sites in the ocean, or (d) if no other alternative is feasible, dumping in designated parts of the Bay where the maximum possible amount will be carried out the Golden Gate on the ebb tides; areas should be designated for this purpose upon approval by both the Commission and the Army Corps of Engineers. This policy is intended to apply as soon as possible to all dredging in the Bay, whether to create new channels or to maintain existing ones . . . ./31/

- In recent years, about 5,000,000 cubic yards of dredge spoils have been disposed of at the Alcatraz aquatic disposal site annually, with about 1,300,000 cubic yards attributable to COE maintenance projects, 1,800,000 cubic yards to Navy maintenance projects, and the remainder to a variety of other activities subject to permit by the COE. The COE is currently studying all in-Bay dredge disposal options, including continued, if modified, use of the Alcatraz site. The dredge spoils generated at Mission Bay would represent less than 1% of the amount disposed annually at Alcatraz. There are problems at Alcatraz with sediment mounding and concerns regarding contamination effects which may limit its use as a disposal site in the future./31/ The COE has estimated that approximately

- 70% of the dredged sediment which is disposed of in San Francisco Bay remains in the Bay. According to the RWQCB, an accumulation of mounding dredged sediments at the Alcatraz site has resulted in a navigational hazard and reduces beneficial uses of the area by degrading benthic habitats. Furthermore, the California Department of Fish and Game has stated that the disposal of dredged sediments may have an adverse effect on the fishery resources of San Francisco Bay and has recommended that disposal in the Bay be reduced. For these reasons, the capacity of the Alcatraz site is limited./31a/

  The disposal of dredged material to the ocean is regulated by the Marine Protection Research and Sanctuaries Act of 1972 (Ocean Dumping Act). The standards applied to analyze proposed spoils for ocean disposal are stricter than COE Section 404 standards./32/ Any material which did not qualify for open water disposal in the Bay would be unlikely to be suitable for ocean disposal.

  If the sediments were disposed of in the Bay off Alcatraz Island (the only active disposal site in the Bay) or in a site to be designated in the ocean, the temporary impacts discussed above in relation to increased turbidity and decreased dissolved oxygen levels would result both in the channel and subsequently at the disposal site. In addition, short-term release of possibly toxic chemicals from the sediments could occur at both sites. If disposal were at an upland site, impacts on water quality would be expected only in the channel during dredging as discussed earlier; the disposal site would be subject to Waste Discharge Requirements of the Regional Water Quality Control Board (RWQCB) with jurisdiction over the disposal area.

- Before dredging were permitted, public hearings would be required by the COE. Similarly, if BCDC or RWQCB permits would be required for any phase of the dredging / disposal process, there would be public hearings before those bodies issued permits. Sediments from both the dredge site and the proposed disposal site would be tested and the results of the analyses compared. BCDC would require that all necessary water quality certifications from the RWQCB and the EPA be approved before BCDC approval for dredging would be given. The applicant would have to perform the needed sediment testing prior to filing BCDC permit applications. Disposal would not be allowed if the dredge spoils would have significant impacts at the disposal site.

Public Use of China Basin Channel. Alternative A would include residential units, offices, and commercial space and about 14 acres of open space along the south side of the channel. Over 30,000 people would be in the Project Area on a work day. With this increase in local population in the vicinity of the channel, public uses such as fishing would likely increase in the channel. The value of the channel as an aesthetic amenity, however, may depend on whether improvements in water quality occur. Swimming and other water contact uses could also occur even if not intended as part of the development plan, and even if prohibited by the City for public health reasons and water quality regulations. Increased use of the channel would expose additional people to potential hazards, such as viral infections like hepatitis, associated with water contact. The possibility of health effects would be greatest immediately following an overflow when combined sewage and stormwater were discharged to the channel. Since overflows typically occur during the colder wet weather months, it is less likely that water contact recreation would occur in the channel at those times.

Initial Phase of Development. Dredging impacts described above would occur during the initial phase of development. About four acres of open space would be constructed along the south side of the channel. As this would be the only developed open space in the vicinity of the 500 dwelling units and other proposed uses, it would likely be well used. Public uses of the channel would increase over existing levels.

Alternative B

Hydrologic Characteristics. Alternative B includes the development of a wetland along the south central edge of China Basin Channel, but no other changes to its overall hydraulics. The edge of China Basin Channel would be modified under Alternative B; changes would be similar to those proposed under Alternative A, except in the wetland area. The outfall area would remain as a soft, natural edge with gabions. The edge treatment along the rest of the channel would consist of decking and gabions. Edge treatment for the pump station and along a small portion of the south side of the channel would be completed during the initial phase of development. The gabions could improve the stability of the banks and prevent bank erosion in the channel, depending on the detailed plans for the edge treatment.

Development of the wetland would change existing flow patterns in China Basin Channel by adding a waterway that could affect flushing characteristics and sedimentation patterns in the channel. The effects of such changes on the hydrology of the channel are unknown at this time because no development plan exists and sufficient information is not available on the hydraulics of the channel. Flushing at the end of the channel might be reduced because tidal action could be dissipated in the wetland channel. As part of wetland design studies, detailed study of the system would be required to determine if a reduction in flushing would occur and, if so, the magnitude of the effect. Sedimentation in the channel, which is occurring at the rate of three to six inches a year, could decrease the amount of tidal flushing. Maintenance dredging is not proposed under Alternative B.

If dredging does not occur, navigational problems could be encountered by boats attempting to use the channel at low tide and flushing of the channel could be reduced.

Water Quality Effects of Wet-Dredging. No wet-dredging of the channel is proposed under Alternative B. Some minor dredging may, however, be needed to complete the edge treatment. For a discussion of wet-dredging, see Alternative A, above.

Public Use of China Basin Channel. At full build-out, the channel would be an integral part of Mission Bay development. The wetland areas and open space would attract users from the residents who would live in Mission Bay, commercial, office and retail workers, and visitors. The use would likely be greatest in the open space area on the south side of the channel. Impacts of increased human exposure would be similar to those discussed under Alternative A.

Initial Phase of Development. Alternative B would have no hydrologic impacts to China Basin during the initial phase of development, other than those which would occur if the edge treatment were constructed.

Alternative N

No change to the hydrologic characteristics of the channel would occur except that due to natural sedimentation in the channel. Dredging is not proposed under Alternative N. If dredging does not occur, the sedimentation of three to six inches per year in the channel could cause navigational problems for boats attempting to use the channel at low tide. The channel would have "natural" soft edges except for the areas where riprap is in place now. The slopes probably would be less stable than those of Alternatives A and B because they would be unsupported as now. More bank erosion could be expected than under the other Alternatives because the soft muds would be exposed to surface runoff.

Under Alternative N, little change in land use near the channel is expected. A narrow open space area would exist south of the channel. Less increase in use of the channel area would be expected than under Alternatives A or B because there would be no new resident population. However, it would likely continue to be used by residents in existing houseboats and by employees in the vicinity.

The population at risk from exposure to polluted channel water would include the houseboat residents. Employees of businesses in the vicinity also may be exposed inadvertently to polluted channel water; Alternative N includes no provisions for water contact or water-oriented recreation.

DEVELOPMENT OF WETLANDS

Alternative A

No wetlands are proposed for Alternative A.

Alternative B

Hydrologic Characteristics

Three wetland areas would be developed under Alternative B by build-out. The mid-channel wetland area (described above) would be located south of the channel, west of Third Street. The China Basin wetland would be along the south side of the channel, east of Third Street. The bayfront wetland would be near the southeastern edge of the Project Area south of Pier 54. The wetlands would include waterways to allow tidal flushing. No hydraulic analyses have been done for any of the proposed wetlands. Studies completed for the China Basin wetland recommend that the waterway bottom have a minimum elevation of -16.8 feet SFD to allow adequate tidal drainage at low tide. The hydraulic analysis also recommends a minimum bottom width of 10 feet./33/ The waterways would be dry dredged; that is, they would not be opened to tidal action until excavations have been completed. Because of the high water table, dewatering probably would be required during excavation.

Creation of wetlands would increase the water surface area of the Bay and therefore would increase its oxygen-absorbing ability. This supports policies of BCDC./34/

Water Quality

Construction of the wetlands would require excavation along the banks of the channel or the Bay. That construction activity would increase the amount of material that could be transported into the channel or Bay, which could increase suspended solids concentration and turbidity. That would be a short-term effect during the construction period.

Sediments on the banks of the wetlands could be contaminated from the Bay, the channel or, possibly, from groundwater contaminants. If leaching of contaminants occurs, water quality in the wetlands, channel, or Bay would be degraded. Potential impacts associated with removal of contaminated sediments from the channel have been discussed under Alternative A, on p. VI.L.24 and following.

Wetlands can tolerate a range of water quality conditions. In general, the most important variables for successful wetland development are sufficient inundation and proper substrate (underlying soil). Wetlands have been used for outfall receiving areas at some wastewater treatment systems because they are capable of removing significant amount of certain pollutants from water, including suspended sediments and nutrients. Wetlands can physically trap pollutants, and biological uptake of pollutants in plants and animals also removes them from waters. General indications from laboratory and field studies suggest that stress in wetland systems occurs at "excessive pollutant concentrations", but data are not available that suggest specific limiting concentrations of pollutants for wetland development./35,36,37/

Poor water quality in the proposed wetlands could have several sources, including Bay water quality, the outfalls, channel sediments, and groundwater. It is not known precisely which pollutants exist in those sources. A viable wetland could improve some aspects of the water quality by trapping sediments, reducing sediment loads and thereby improving water clarity. The effects on the channel water quality probably would not be visibly noticeable. The water quality in the wetland waterway would depend as well on flushing characteristics. Poor circulation could result in degraded water quality conditions, such as lowered dissolved oxygen concentrations and increased algal growth and thus lower habitat value in the wetlands. Over time, sedimentation could reduce the depth of the waterway, impeding circulation and increasing water temperatures. Maintenance wet-dredging of the waterway probably would be required to maintain appropriate depths and to maintain the appropriate distribution and composition of wetland vegetation./35/

Sedimentation patterns play an important role in the evolution of a wetland. Sediment is transported to the wetland with incoming high tides and deposited during slack water. On the outgoing tide, part of the sediment would be resuspended. In the long-term, sedimentation and encroachment of vegetation would cause the wetland to evolve from mud flats entirely to salt marsh, unless action were taken to retain the mud-flat environment.

The quality of urban runoff is discussed above (see p. VI.L.14). If urban runoff flows into the wetland, urban pollutants, such as heavy metals, nutrients, and organic chemicals, would degrade the water quality of the wetland and could harm its vegetation and wildlife. Under most conditions, runoff from the Project Area would be collected in the sewer system and would not be directed to the wetland.

Leaking tanks of petroleum products or other potentially toxic chemicals or contaminated soils may exist in the area. If contaminated groundwater seeps into the wetland, it would degrade its water quality and possibly harm vegetation and wildlife.

The location of wetlands adjacent to an urban area could result in accumulation of trash, floating debris and algae along the edges of the wetlands. Many people may perceive of the "wild" character of the wetland as making it suitable for unauthorized dumping. Periodic removal of such material would be required./24/ Moreover, illegal dumping of hazardous materials ("midnight dumping") might also occur, possibly resulting in devastating effects on vegetation and wildlife.

Under best-case assumptions, water quality would not cause a problem for wetland development. This would be true if channel and groundwater quality and tidal flushing are sufficient and if excessively polluted urban runoff does not enter the wetland.

Under worst-case assumptions, some or all of the water quality factors would be poor enough to significantly adversely affect wetland development. If toxic substances occur in the wetland, the vegetation could fail to take hold or, following initial success at establishment, subsequently could be damaged. This is discussed in VI.M. Vegetation and Wildlife, p. VI.M.19. If that occurs, the wetland would not function to improve surface water quality since both vegetation and hydrological interactions are closely interdependent. If groundwater and sediments in the vicinity of the marsh were to cause such degradation, remedial action to improve groundwater quality could also allow development of the wetland. If that is not technically or economically feasible, the wetland probably would not flourish or could become a source of contamination for wildlife.

China Basin Wetland

Because of its location at the Bay, circulation is not expected to be a problem within the China Basin wetland./24/ China Basin wetland could affect the existing local flow patterns near the mouth of the channel and affect sedimentation or erosion patterns in the channel; the effect would depend on the interaction between the hydraulics of the Bay, China Basin Channel and the new wetland channel. Wave action from the Bay could erode the outer banks of either wetland area.

Mid-Channel Wetland

Because the mid-channel wetland would be inland from the Bay and connected to the channel, there are concerns about water circulation and water quality in it. Tidal flushing is expected to be poorer at the mid-channel location than at the China Basin wetland, so a different channel configuration from that identified for the China Basin wetland may be necessary. To maintain adequate tidal flushing a deeper or wider channel may be required.

The water quality of the mid-channel wetland would be affected by that of the channel. Of the three wetland areas proposed, the mid-channel area would be subject to the worst water quality conditions because tidal flushing is weaker there than at the other two sites and because this wetland is closest to the combined stormwater/sewer outfalls.

Development of the mid-channel wetland would require the removal and reconstruction of the large storage sewer beneath Channel Street and portions of the sewer along Fourth Street (see VI.D. Community Services and Infrastructure, Sewers and Waste Treatment, p. VI.D.106)./38/

Bayfront Wetland

All tidal water entering the bayfront wetland would pass under China Basin Street. If that passageway were too constricted, then adequate circulation and flushing would not occur in spite of its generally favorable location immediately adjacent to the Bay.

The construction of the bayfront wetland would not be expected to have any overall impacts on tidal flow and water exchange in the channel or Bay. The construction of the wetland would not affect Bay circulation, except for minor, local changes of flow into the new waterway. The estimated sedimentation rate in the China Basin wetland is projected to be similar to that in China Basin Channel near Fourth Street; that is, about one-half foot per year in deeper water, e.g., at -22 feet SFD. As the water becomes shallower, the sedimentation rate decreases and is about one-quarter foot per year at -11 feet SFD./33/

Alternative N

No wetlands would be developed under Alternative N.

MITIGATION

Measure	Alternative	Description
L.1	A,B,N	During construction, if piles of dirt are to remain in the Project Area, minimize degradation of water and air quality due to erosion by the following measures where appropriate: – Install filter fences, haybales, or both to slow water and remove sediments; – Plant surface with grasses; or – Cover soil with stabilizing coatings or plastic sheeting. Planting annual seedlings could reduce soil losses by as much as 90%. Jute or excelsior mats could reduce them by 70% to 80%./39/
L.2	A,B	For all wet-dredging: – Dredge during times when tide and runoff are expected to cause high turbidity independently of dredging; – Dredge during times when tide and runoff would not carry excessive suspended material from the channel into the Bay; – Avoid dredging when herring are expected to spawn.
L.3	A,B	For wet-dredging with suction equipment, employ best practices for reducing turbidity, such as those discussed by Huston and Huston./40/ These practices include: – Turning the cutter as slowly as possible within the confines of economical production. Usually slower speeds are more economical and create less turbidity. – Avoiding burying the cutter unless all the material can be picked up by the suction.

Measure	Alternative	Description
		– Using a rotating suction assembly whenever possible. This permits using smaller cutters that create less material disturbance. – Using dredges of proper size. Hulls that are too wide, long or deep create turbidity by hitting the sides and bottom of the cut. – Keeping anchor wires free of soft bottoms and banks to prevent disturbance and caving of material. – Keeping pipeline connections tight, particularly on floating lines. – Using proper methods of swing and set to pick up all material.
L.4	A,B	For all wet-dredging with buckets: – Use "tight-bucket" clamshell dredging equipment to minimize loss of sediments into the water column and drop of sediments into the water. – Install siltscreens to minimize sediment movement away from the dredge site.
L.5	A,B,N	To reduce peak runoff flows and overflows, employ devices such as rooftop or surface detention structures where feasible to hold runoff so that it could be released more slowly over a longer period of time. Surface detention structures, for example, could be located under gratings in parking lots or could be decorative, gravel-filled depressions which receive water from impervious areas such as rooftops or sidewalks. Their areas and volumes would be highly variable. Open space areas could be designed to contain landscaped depressions that will temporarily receive stormwater runoff: these could be drained or pumped out following the passage of the peak flow of runoff.

Measure	Alternative	Description
		Rooftop detention structures would require flat roofs and sufficient reinforcement of the structure to support the added weight of the water, especially if an earthquake were to occur while the roofs were loaded; they could be visually intrusive. Additional energy would be used to pump water from cisterns.
L.6	A,B,N	To reduce sediments in the sewer system and at the treatment plants, install and maintain sediment and grease traps in local stormwater intakes during the construction period and clean wheels and cover loads of trucks carrying excavated spoils before they leave construction sites.
L.7	A,B,N	Employ best management practices to reduce the accumulation of pollutants on the street surfaces. Such practices include street sweeping, pet and rodent control, and minimizing the use of pesticides and herbicides for landscaping.
L.8	B	Study hydrology and water quality of China Basin Channel or the Bay at each wetland site to determine design constraints or advantages of each site, including: – Local tidal flushing characteristics because inadequate flushing could preclude development of a wetland and would need to be considered for the appropriate waterway configuration. – Sedimentation rates and type of sediment that would be deposited to determine if appropriate substrate for wetland development would be available. – Water quality characteristics, particularly toxics, in the channel and the groundwater to determine if cleanup would be required prior to wetland development.

Measure	Alternative	Description
L.9	B	If surface water or groundwater contamination is determined to be at levels that would harm wetland vegetation or wildlife, perform cleanup operations prior to development of the wetland. As necessary, remove contaminated soil, repair leaking underground storage tanks, clean up or pump contaminated groundwater, or design actions to improve water quality in the channel.
L.10	B	Design wetlands to ensure proper flushing and drainage throughout the tidal cycle. That would limit the potential for certain water quality problems, improve the viability of the wetland, and reduce the potential for mosquito infestation. If tidal flushing is inadequate, pumping could be used to maintain proper flushing; pumping would use energy.
L.11	B	Construct the wetlands and design the local stormwaters collection systems in surrounding parks and open spaces to ensure that urban runoff (possibly containing soil, organic materials, pesticides, herbicides and other pollutants) would drain into the city sewer system and not flow into the wetland, except under extraordinary conditions such as flooding. That measure would greatly reduce the potential for urban runoff typically containing soil, heavy metals, organic material, oils, phenols, coliforms to affect the water quality of the wetland. Sewer systems designed to city standards would be built in existing and new streets and would collect urban runoff as well as sewage from surrounding areas./41/
L.12	A,B,N	Thoroughly investigate existing and potential groundwater contamination on the site prior to development, including

Measure	Alternative	Description
		the relationship between the groundwater flow regime and the channel and Bay system. Take remedial action for any existing pollution problems, if appropriate.
L.13	A,B,N	Use corrosion-resistant pipes and underground storage tanks to reduce corrosion and the potential for underground pipe and storage tanks leakage into the groundwater.
• L.14	A,B,N	To protect the public from health hazards posed by exposure to water in China Basin Channel following wet-weather sewage overflows or leaks caused by accidents or emergencies, such as earthquakes, install railings and barriers to restrict access to the channel. Place multi-lingual explanation and warning signs along the channel explaining potential health consequences of water contact or eating fish caught in the channel.
• L.15	A,B,N	Structures in the Project Area should be designed and located in such a way to assure the reasonable safety of structures and shoreline protective devices built in the Bay or in low-lying shoreline areas from the dangers of tidal flooding, including consideration of a rise in relative sea level. BCDC recommends using a sea-level rise estimate of 0.005 to 0.05 foot per year as a planning guideline for developing waterfront land uses. Detailed construction specifications to mitigate against impacts of a sea-level rise, however, would require specific flood protection engineering and building analysis by a licensed engineer, using the criteria identified by BCDC./20a/
•		Measures include:
•		- setback from the water's edge;
•		- installation of seawalls, dikes, and/or berms during construction of infrastructure;
•		- provisions for dewatering basements;

	Measure	Alternative	Description
•			– elevated uplands near wetlands and design of wetlands so that islands and refuges for small mammals and birds may be periodically increased in elevation if this becomes necessary (Alternative B only);
•			– construction of streets and sidewalks above existing grades by reducing the amount of excavation for utilities or basements;
•			– use of topsoil to raise the level of public open spaces;
•			– use of half-basements and partially depressed garage levels to minimize excavation.

NOTES

SETTING

/1/ Olmsted, Roger, Nancy Olmsted, D. Fredrickson, and V. Bente, "San Francisco Bayside: Historical Cultural Resource Survey," a report submitted to the San Francisco Clean Water Program, 1982.

/2/ California Regional Water Quality Control Board, San Francisco Bay Region, Water Quality Control Plan, San Francisco Bay Basin (2), 1982, and Proposed Amendments, 1987.

/3/ California Regional Water Quality Control Board, San Francisco Bay Region, Water Quality Control Plan, p. 4-12.

/4/ California Regional Water Quality Control Board, San Francisco Bay Region, Water Quality Control Plan, p. 4-25.

/5/ The five-year storm is the largest storm likely to occur, on the average of once in five years.

/6/ Dames and Moore, Preliminary Report, Geotechnical Consultation, Mission Bay Development, San Francisco, April 15, 1982.

/7/ Dames & Moore, Geotechnical Consultation, Mission Bay Project, December 1, 1982.

/8/ Information on known underground storage tanks (USTs) in the Project Area is based on information provided to ESA by Santa Fe Southern Pacific Realty Company, the San Francisco Public Health Department, and the Regional Water Quality Control Board. The San Francisco Fire Department, the Department of Health Services, and the US EPA also were contacted by ESA.

/9/ Williams, P.B., J. Haltiner and C.C. White, Jr., Preliminary Analysis of a Circulation Design for Mission Bay Project, Philip Williams and Associates, San Francisco, CA, 1986.

/10/ Mean lower low water (MLLW) is the average height of the lower of the two low tides each day. Similarly, mean higher high water (MHHW) is the average of the two higher daily highs.

/11/ City and County of San Francisco, "Bayside Overflows," prepared by CH_2M Hill Engineers, San Francisco, California, 1979.

/12/ San Francisco Clean Water Program, Annual Report, North Shore Receiving Water Monitoring, July 1985-June 1986 and July 1986-June 1987.

/13/ The Soluble Threshold Limit Concentration (STLC) is the concentration of a solubilized and extractable bioaccumulative or persistent toxic substance which is equaled or exceeded in a waste or waste extract renders the waste hazardous (California Code of Regulations, Title 22, Section 66194). STLCs have been established for 19 inorganic and 17 organic substances, (Title 22, Section 66699).

/14/ The Total Threshold Limit Concentration (TTLC) is "the concentration of solubilized, extractable, and nonextractable bioaccumulative or persistent toxic substance which, if equaled or exceeded in a waste, renders the waste hazardous" (California Code of Regulations, Title 22, Section 66206). TTLCs have been established by the Department of Health Services for 20 inorganic substances and 18 organic compounds (Title 22, Section 66699). The standards for TTLCs are given in mg/kg wet weight, whereas the analyses of China Basin Channel sediments were reported as mg/kg dry weight. Therefore, without additional knowledge about sediment moisture content, the two are not comparable.

/15/ Arleen Navarret, Water Quality Chemist, San Francisco Clean Water Program, Southeast Water Pollution Control Plant, interview, June 22, 1987. Data for the past few years of sampling in the channel was provided.

/16/ J.M. Dela Cruz, San Francisco Clean Water Program, interview, September 25, 1986. A record of this meeting is available at the Office of Environmental Review, Department of City Planning, 450 McAllister Street, San Francisco.

IMPACT

/17/ Goldman, Steven J., Katherine Jackson, and Taras A. Bursztynsky, Erosion and Sediment Control Handbook, McGraw-Hill, New York, 1986. For a description of the assumptions made to arrive at the soil loss estimates, see Appendix XIV.J. p. XIV.J.14.

/18/ D.M. Champeau, San Francisco Clean Water Program, letter, August 7, 1987. A copy of this letter is available at the Office of Environmental Review, Department of City Planning, 450 McAllister Street, San Francisco.

/19/ David Jones, San Francisco Clean Water Program, telephone conversation, April 21, 1988.

/20/ If sea level were to rise, flooding would occur more frequently. An intermediate rate of sea-level rise of four feet during the next century (the range presented by the EPA is 2 to 8 feet) would place the 100-year tidal event at +2.0 feet SFD by the year 2090. Any parts of the Project Area which had subsided to that elevation would be subject to flooding during tides as high or higher than the 100-year event. Williams, P.B., An Overview of the Impact of Accelerated Sea Level Rise on San Francisco Bay, December 20, 1985.

• /20a/ San Francisco Bay Conservation and Development Commission, "Staff Recommendation on Bay Plan Amendment No. 3-88 Concerning Sea Level Rise in the Bay," December 1988.

/21/ San Francisco Clean Water Program, Wet Weather Operation Summary Table, 1985-1986.

/22/ San Francisco Clean Water Program, Bayside Wet Weather Annual Summary, North Shore and Channel Street Systems, 1986-1987.

/23/ T-wall: A T-wall is a concrete retaining wall, constructed in the shape of an inverted "T," which would be used to provide support for hard-edged, straight sides along China Basin Channel. The base of the "T" would be longer than the vertical. The part of the base pointing toward the channel would serve as a hard channel bottom adjacent to the channel

	edge. The other branch of the base would be buried landward of the channel. Dredging along the T-wall would be done using a drag-line after the T-wall had been constructed.
Gabion:	A gabion consists of broken rock held in place by firmly anchored wire or cable netting. It would be used to prevent slumping and erosion of exposed mud.
Decking:	Decking would consist of wooden walkways along the channel. The decking would be supported on concrete footings adjacent to the channel and on piers sunk near the edge of the channel.

• /24/ R.W. Barton, President, KCA Engineers, telephone conversations, July 16 and July 20, 1987.

/25/ Brannon, J.M., Evaluation of Dredge Material Pollution Potential, Technical Report, DS-78-6, U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS, 1978.

/26/ San Francisco Bay Regional Water Quality Control Board, U.S. Army Corps of Engineers, and U.S. Environmental Protection Agency, Joint Public Notice No. 87-1, Interim Testing Procedure for Evaluating Dredged Material Suitability for Open-Water Disposal in San Francisco Bay, June 29, 1987.

/27/ U.S. Army Corps of Engineers, U.S. Army Engineer District, San Francisco, Dredge Disposal Study, San Francisco Bay and Estuary, Appendix F, Crystalline Matrix Study, 1975.

/28/ U.S. Congress, Office of Technology Assessment, Wastes in Marine Environments, OTA-0-334, Washington, D.C., U.S. Government Printing Office, pp. 237-253, 1987.

/29/ San Francisco Department of City Planning, September 1986, "Canal Systems," Special Study for Mission Bay, Section V, Mission Bay Canal Alternatives, KCA Engineers, August 1982.

/30/ CH$_2$M Hill, study prepared for Jefferson Associates, May 6, 1983.

/31/ Final EIS: Homeporting: Battleship Battlegroup Cruiser/Destroyer Group, prepared by Environmental Science Associates, Inc. for U.S. Department of the Navy, Western Division Facilities, Engineering Command, San Bruno, California, July 1987.

• /31a/ California Regional Water Quality Control Board, San Francisco Bay Region, Tentative Resolution No. 89, "Policy for the Regulation of Dredged Sediment Disposal in the San Francisco Bay Region."

/32/ San Francisco Bay Conservation and Development Commission, Staff Report on Water Quality in San Francisco Bay, January 1987.

/33/ San Francisco Department of City Planning, September 1986, "Wetlands/Playfields," Special Study for Mission Bay, San Francisco, Appendix B, Hydrologic Analysis, prepared by Phillip Williams and Associates.

/34/ San Francisco Bay Conservation and Development Commission, San Francisco Bay Plan, adopted January 1969, amended July 1979.

/35/ Krone, Ray, "Engineering Wetlands: Circulation, Sedimentation and Water Quality" in Michael Josselyn, ed., Wetlands Restoration in California, December 1982, Tiburon Center for Environmental Studies, California Coastal Commission and Coastal Heritage Foundation, Report No. T-CSGCP-007.

tide level in an intermittent, narrow band, varying in width from 0.5 to 1.5 meters. This species, which is the dominant plant of San Francisco Bay marshes, is adapted to tidal inundations but intolerant of continuous submergence. Green alga (Enteromorpha sp.) occurs seasonally in the outer and middle portions of the channel. At the bay entrance to the channel, a marine plant community occurs on the rocks and pilings and is indicative of ambient bay conditions. At the head of the channel near the pump station and overflow structure, the banks of the channel have only introduced weeds and grasses and marine vegetation is lacking. The bottom sediments have a layer of Sphaerotilus sp., a fungus commonly associated with sewage discharges. The filaments of this fungus are the main component of a microbial complex commonly called "sewage fungus," which is the slime-like substance found on rocks in waterways receiving sewage pollution./6/ The contamination levels in sediments at the head of the channel are likely a significant factor for the lack of marine vegetation there, although no studies exist that have determined the reason for the lack.

Wildlife

The open waters of San Francisco Bay provide habitat for large numbers of birds that migrate along the Pacific Flyway. The birds use offshore bay waters for resting, feeding and wintering areas. Some birds use inshore tidal creeks, channels and sheltered areas around piers. The urban character of the project site and lack of terrestrial vegetation for food and cover limit the Project Area's habitat value for wildlife.

• China Basin Channel is used by water birds, such as ducks, gulls, terns, shorebirds, pelicans, loons, grebes, cormorants, herons, and egrets. Bird censuses were conducted on February 18 and 26 and on March 14, 1986, for the project site and adjacent areas./7/ Appendix K. Vegetation and Wildlife, Table XIV.K.1, p. XIV.K.1, lists common bird species that were sighted or would likely occur in the study area. Snowy egrets, great egrets, great blue herons, and black-crowned night herons are among those species commonly foraging in the area of China Basin Channel at various times and on a year-round basis. Several dozen of these birds may be observed here, but it is unlikely they nest in the area for lack of adequate habitat. Egrets, herons and other water birds have been observed along the channel well beyond Fifth Street. Many of the species noted in the China Basin Channel area were water-related and are migratory and use the area for resting periods of various duration. Others are winter residents that migrate elsewhere for breeding. The number of year-long resident species is not known. Birds detected in the censuses were primarily water-related species, which are present in San Francisco Bay in fall and winter, but leave in the spring to breed elsewhere. The lack of suitable vegetation for cover and absence of trees render the project site unlikely for any breeding use by these species, except possibly the Forster's tern.

Terrestrial birds in the area also include various species of common songbirds such as sparrows, starlings and blackbirds that are typical of urban areas. An American Kestrel (Falco sparverius), formerly known as sparrow hawk, was observed in 1983 in the vicinity of the China Basin Building. This species eats rodents and large insects, and is known to nest in niches of buildings.

The California brown pelican (Pelecanus occidentalis) is the only rare or endangered bird species that occurs along the Mission Bay shoreline. The brown pelican is officially listed as Endangered by the U.S. Fish and Wildlife Service and by the State of California./8,9/ Pelicans are regular summer migrants to San Francisco Bay, and are commonly seen diving for fish and perching on bayside pilings. After a severe decline in the early 1970s, caused by reproductive failures related to pesticides, their numbers are now steadily increasing. The number of pelicans in the vicinity of Mission Creek is low. Their low numbers can be attributed to an inadequate food supply, principally northern anchovy and topsmelt, in the area.

The lack of suitable cover and food resources limits also the terrestrial mammals to those species commonly occurring around industrialized urban areas, including the black or Norway rat, house mouse, meadow mouse, and gopher in addition to domestic dogs and cats. No rare or endangered species are known to exist or likely to inhabit the Project Area or vicinity.

While no large terrestrial mammals are resident in Chinal Basin Channel, harbor seals (Phoca vitulina richardii) and California sea lions (Zalophus californianus) are regular visitors to the outer reaches of the channel and on occasion can be seen beyond Fifth and Sixth Streets. There are several populations of harbor seals in San Francisco Bay; the animals that have been observed in the waters in the vicinity of the Project Area could belong to any one of these wide-ranging populations. The industrial activity and quality of the bank slope substrate likely would preclude the animals from entering the channel; however they may possibly haul out on the rocks at the entrance to the channel.

Aquatic Habitat

The present China Basin Channel is not a naturally occurring tidal creek but the remains of the former Mission Bay. In an assessment of the benthic (bottom dwelling) community in China Basin Channel done in 1979 by CH_2M Hill Engineers, the community structure exhibited low species diversity, productivity and habitat value in comparison to the benthos found in the open Bay by the mouth of the channel. The combined sewer overflows, which enter near the head of China Basin Channel, contribute to the degraded nature of this waterway, as does the dead-end slough configuration of the channel. However, in the absence of an extensive monitoring and sampling program, an objective, quantitative definition of the water quality problem and its relationship to aquatic habitat in the channel does not exist.

Sewage overflow discharges, generally occurring in the winter and spring, have reduced the value of aquatic habitat in China Basin Channel, particularly in the reach upstream of the Fourth Street Bridge. Because of tidal exchange in the channel, most water quality impacts of overflows have been shown to be short-lived beyond the storm event creating the overflow/10,11/; however, sediment and biological impacts are likely to be more persistent (see VI.L. Hydrology and Water Quality, p. VI.L.10). Those discharges contribute settleable particulate matter containing heavy metals, inorganic and organic matter which, through oxidation, place a high oxygen demand on the sediments and overlying waters, contributing to anaerobic conditions./12/

Past studies of the benthic community and fish population in upper China Basin Channel show reduced numbers and species of typical estuarine organisms, when compared to the area bayward of the Third Street Bridge./9/ Bottom grab samples taken during these surveys showed the upper China Basin Channel nearly void of benthic organisms (biomass varying from nearly zero to 4.8 grams per 0.05 square meter). Sediment chemistry data also show that sediments at the head of the channel are unsuitable for bottom-dwelling organisms. The predominance of mollusks and polychaetes, in terms of biomass, suggests that the benthic community is stressed. A list of the most abundant benthic invertebrate species collected during the 1979 survey of the channel is provided in Table XIV.K.4, p. XIV.K.2 of Appendix K.

Foraging area and habitat, which could contain food sources such as marine plants, burrowing clams, mussels, annelids (tube worms), and crustaceans (crabs, shrimp, isopods, etc.), are provided by piles, walls and dock structures. However,the quality of upper China Basin Channel sediments (above the Fourth Street Bridge) and associated biological community provide virtually no foraging area for bottom-feeding fish species. Between the Fourth and Third Street Bridges, sediments still have high organics and metal concentrations and oxygen deficient conditions; therefore, that reach provides only marginal habitat and foraging for fish./10/ The fish community bayward of the Third Street Bridge is likely to contain a more representative collection of San Francisco Bay species on a permanent or transitory basis. Those individuals are likely to follow the flood tide into the China Basin Channel to forage, then migrate outward to the Bay during the ebb tide. Thus, the outer portion of China Basin Channel provides an important foraging area for many common Bay fish species.

During the combined sewer overflow studies, trawls performed in the inner channel (upstream of the Fourth Street Bridge) at high tide yielded a few individuals of the following species: Pacific herring (Clupea harengus pallasii), shiner surfperch (Cymatogaster aggregata), Northern anchovy (Engraulis mordax), and one speckled sanddab (Citharichthys stigmaeus). Trawl catches in the Bay at the entrance to China Basin Channel revealed a greater number of species as listed in Appendix K. Table XIV.K.3, p. XIV.K.5. In fact, the waters immediately outside other channels yielded the highest numbers of fish caught of six San Francisco bayside areas sampled./10/ However, by comparison to similar trawls conducted at sites outside the channel (i.e., bayward of Islais Creek, Sunnydale and Yosemite Channel), the species number and diversity in the China Basin Channel was very poor.

Table XIV.K.4, p. XIV.K.6 of Appendix K., presents a list of the common sport and commercial fishes expected to appear in the vicinity of the China Basin Channel entrance and possibly within a portion of the channel during the year. Other species also may be recorded on an occasional or migratory basis.

The Pacific herring fishery is one of the last remaining commercial fisheries in San Francisco Bay. The current fishery began in 1973 and specializes in herring roe (eggs) rather than the fish itself./13/ The roe is exported to Japan, where it is considered a delicacy. Consequently, commercial exploitation coincides with spawning of the herring in the Bay from November to March. Peak spawning months are typically December through February.

- Because of its commercial importance, Pacific herring populations and spawning success are closely monitored by the California Department of Fish and Game. In recent years, studies have indicated increased herring spawning activity along the San Francisco waterfront, including the shoreline east of the Mission Bay Project Area./14/ Marine vegetation, pier pilings, riprap and other "hard surfaces" provide the preferred substrate for herring spawning./15/ The shoreline east of the Project Area is herring spawning habitat /16/; some use of the middle and upper reaches of the China Basin Channel by herring has been observed and reported by local residents.

- The 0.5- to 1.5-meter-wide pickleweed strip that sporadically occurs along the south side of the channel, where subject to tidal flooding, could provide some habitat for fish spawning (other than herring), but conditions are marginal. Pickleweed edges also are an important feature of large areas of some tidally influenced wetlands.

No rare or endangered fish species are known to exist or likely to inhabit the waters of China Basin Channel or San Francisco Bay in the vicinity of the Project Area.

IMPACT

TERRESTRIAL AND WETLAND VEGETATION / WILDLIFE

U.S. Fish and Wildlife Service, U.S. National Marine Fisheries Service, and California Department of Fish and Game do not have policies or plans specifically applicable to Mission Bay. In the San Francisco Bay Plan, BCDC has developed policies concerning fish and wildlife in San Francisco Bay. Those policies encourage the retention and restoration of marshes and mudflats in San Francisco Bay./17/

Alternative A

At build-out, there would be a total of 55.3 acres of open space potentially suitable for wildlife habitat (see Table VI.D.15, p. VI.D.77). Landscaped open space would comprise 43.3 acres, the remaining 12 acres would be open water in China Basin Channel.

• The open space would be landscaped parklands. Public access and recreation would be allowed in all open areas. No wetlands or additional open water habitat over present conditions would be created. Specific plans have not been developed, but most of the "natural" shoreline along China Basin Channel would be eliminated by construction of rock and wire gabions, wooden decking and concrete T-wall. Of the three types of edge treatment, wooden decking would provide the most habitat value, as some birds would be able to use mudflat areas beneath the decking for feeding and hiding. A small amount of "natural" soft edge (i.e., earthen, with vegetation) shoreline would remain unaltered around the outfall area at the head of the channel. Thus, most existing heron, egret and shorebird feeding sites would be lost. Hard-edge treatment eliminates exposed soft mud and pickleweed which provides feeding areas for wading birds and for shorebirds. It is possible that some displaced individual animals may die. However, that loss of as many as 20 individuals would not present a threat to the survival of any of those species.

The landscaped parklands would be open space with lawns, shrubs, trees, maintained gardens and playing fields. They would be urban in character rather than natural and untended. A mix of active and passive recreation would occur in the park. Dogs, cats, and human activity would reduce the value of the area for some wildlife species such as ground nesting birds. A variety of tree and shrub species would be used in the plantings, offering cover and nest sites for birds. Most plant species would not be native to the area. Depending on the species planted, shrubs and trees may provide a food source for hummingbirds and fruit-eating birds./18/ Emphasis on using berry and other fruit-producing species would enhance the value for wildlife. Some open space areas would be long narrow strips less than 50 feet wide (OS-4, OS-9, OS-10, and OS-11 shown in Figure VI.1.12, p. VI.1.58). Because of human activities in adjacent areas, those corridors would receive limited use by wildlife.

Animals that are not sensitive to human activity and disturbance would be expected to use the open space areas. Areas with high recreational use (such as occurs at the Marina Green) would offer less wildlife use than areas with less intense recreation activity. Land birds expected to use the park-like open space include rock dove, mourning dove, American robin, northern mockingbird, European starling, brown towhee, white-crowned sparrow, Brewers blackbird, house finch and house sparrow./19,20/ These are all common species in urban parks. The open land areas would provide feeding, roosting and breeding habitat for these species. The majority of the birds are expected to be non-native species: Rock dove, European starling and house sparrow. Black rat, roof rat, house mouse, pocket gophers and domestic cats and dogs would comprise the expected mammal species./21/ After the construction period, raccoons may occur in the Project Area if there are nearby populations. California slender salamander and western fence lizard are expected to inhabit the park areas./22/

By the year 2020, the increased acreage of open space habitat is expected to support increased numbers of animals over the year 2000 condition. However, increased human recreation in those park areas, relative to the year 2000, may reduce the use of these areas by some species, such as white-crowned sparrow./19/ The park areas would provide feeding, roosting and breeding sites for birds. Human activity could reduce wildlife use of the park areas, thereby offsetting the benefits of increased habitat area.

Vegetation established in parkland earlier in the development process would be more mature by the year 2020; trees would be larger and shrubs more developed. The vegetation would provide increased cover and food production per acre for wildlife compared to the year 2000; this would increase the value of the site to terrestrial wildlife.

• The open water in China Basin Channel would continue to provide feeding and resting habitat for common gulls and waterbirds. Typical species expected to use the channel are Western grebe, Western gull, California gull, mallard, double-crested cormorant, cinnamon teal and lesser scaup./19,20/ Increased human activity in adjacent areas would substantially reduce or eliminate heron and egret use of the shoreline. The small number

- of displaced birds, notably herons and egrets, would likely continue to forage in other parts of the Bay Area. Long-term loss of edge habitat would contribute to some degree cumulatively to similar regional habitat losses and thus to declines in these user bird species. However, there is no evidence, so far, that this decline would endanger the total population of herons and egrets in the Bay region. Human activity and lack of protected sites probably would preclude nesting by waterfowl and shorebirds along the shoreline and elsewhere in the Project Area. As nesting is not known to occur at present, this Alternative would represent a continuation of the existing conditions that inhibit nesting.

- Harbor seals and sea lions would not be expected to use the open water habitat provided by China Basin Channel because of disturbance from boating and other human activity. They may, however, occasionally use waters at or near the mouth of the channel as feeding areas.

- The U.S. Army Corps of Engineers (COE) automatically has jurisdiction, and thus must permit actions, up to Mean High Water (MHW) level based on Section 10 of the Rivers and Harbors Act as this defines the upper edge of "Navigable Waters." The COE also takes jurisdiction in "Waters of the U.S.," which includes coastal wetlands, under Section 404 of the Clean Water Act.

- The portions of the channel banks that support pickleweed and are saturated with tidal water meet the requirements of the U.S. Army Corps' Wetlands Delineation Manual./22a/

- Channel development that involves removal of vegetation and new riprapping would require Corps Section 10 and Section 404 permits (see Table VI.A.4 on p. VI.A.69, and text on pp. VI.A.70-VI.A.71). Channel dredging also would require a Section 404 permit. During the Corps permitting procedure, the Corps is required to consult with the U.S. Fish and Wildlife Sevice, the California Department of Fish and Game, and other state and federal agencies including the Environmental Protection Agency; in this way, these two non-regulatory agencies would have a role in directing the conditions of regulatory permits. BCDC has direct regulatory permitting power along the channel.

- The removal of the intermittent, narrow band of pickleweed, however marginal it may be in habitat value, is not in conformance with the Wetlands Resources Policy of the California Fish and Game Commission /22b/, Finding III, which states "projects which impact wetlands are damaging to fish and wildlife resources if they result in a net loss of wetland acreage or wetland habitat value."/22c/ The action is, therefore, not in conformance with the San Francisco Master Plan, Environmental Protection Element,

- Objective 8, "to ensure the protection of plant and animal life in the City," Policy 1, "cooperate with and otherwise support the California Department of Fish and Game and its animal protection programs," and Policy 2, "protect the habitats of known plant and animal species that require a relatively natural environment."/22d/

Initial Phase of Development.

- Under Alternative A, there would be a total of 6.5 acres of open space in the initial phase of development and an additional 12 acres of open water habitat in the channel. About 5.6 acres of that open space would be potentially suitable as wildlife habitat. The shoreline of the channel would be developed and most existing shorebird and wading bird feeding sites, including those for egrets and herons, would be lost. Dredging the channel and construction nearby would disrupt birds using open waters during the period of construction.

Alternative B

At build-out, there would be a total of 94.1 acres of open land potentially suitable for wildlife habitat by the year 2020 (see Table VI.D.15, p. VI.D.77). Park-like open space would comprise 45.3 acres and 33.8 acres would be tidal wetlands; the remaining 12 acres would be open water.

- A mix of active and passive recreation would occur in the landscaped open land areas. Passive recreation is proposed along the edges of the three wetlands. An increase of approximately three acres in open water habitat over present conditions is planned. Most of the existing shoreline along China Basin Channel would be eliminated by the construction of rock and wire gabions and wooden decking. A small amount of "natural" soft edge (i.e., earthen with vegetation) shoreline would remain around the outfall area. By the year 2000, heron, egret and some shorebird feeding sites along the mid-channel would be removed and replaced by a larger area of wetlands. In addition to shorebirds, herons and egrets are expected to use the wetlands.

Human use of the wetlands would be limited to nature observation and appreciation from walkways and observation platforms along the perimeter of the wetlands. Pets would not be allowed into the wetlands; however, some uncontrolled entry of dogs and cats may occur. The incursion of occasional dogs and cats would disturb the wildlife. Walkways into the wetlands would increase the ease of access by humans and pets and, therefore, the frequency of such disturbances. For this reason, only perimeter viewing walkways and steep wall construction along the edges are encouraged. Those controls would help limit disturbance to the vegetation and wildlife that are expected to occur in the wetlands.

- The landscaped parkland areas would be similar to those described under Alternative A. Those areas would provide habitat for human-tolerant birds and mammals. The same assemblage of species expected under Alternative A is also expected under Alternative B. Wildlife in the smaller area of habitat would be more subject to disturbance from human activity. This would favor human tolerant species such as rock dove (pigeon), European starling, Brewer's blackbird and house sparrow. In 2000, Alternative B would have 17.1 fewer acres of open land than Alternative A, and thus, would be expected to support fewer animals likely to use this habitat than Alternative A. At build-out there would be almost triple the acreage of open land available in the Project Area in 2000. Thus, the site would be expected to support more individuals than in 2000. Vegetation established by 2000 would be more mature by the year 2020. Larger trees and more developed shrubs would offer increased cover and per acre food production for wildlife. Thus, the maturing vegetation would increase the value of the site for terrestrial wildlife.

- The 13.2 acres of tidal wetlands created by 2000 along China Basin Channel west of Fourth Street (mid-channel site) would contain mudflats, open water and salt marsh, and an island. Pacific cordgrass and pickleweed would be the plant species expected to eventually colonize and dominate the salt marsh community./23/ Jaumea, saltgrass, and gumweed are other plants that are normally encountered in a tidal salt marsh.

- The mid-channel wetland initially would have limited vegetative cover and therefore would not provide refuges for wetland animals. New planting included in development of the wetland would shorten the time required for vegetation to establish on marsh elevations (1.5 to 3.5 feet NGVD) and preclude most ruderal (weedy) and nuisance plants which would otherwise take over the upper elevations of the site. Ruderal and nuisance plants would provide minimal value to aquatic and terrestrial animals.

- As vegetation matures, the island would provide a protected area for waterfowl, shorebird, heron, and egret roosting. Brewer's blackbirds from the park area may also use the island for feeding and resting. A buffer zone of vegetation, elevation difference or distance would be required around the wetlands to shield the area from human activity and disturbance (see Mitigation); this would enhance the area for use by other more sensitive, human-intolerant birds, such as the shorebirds, egrets and herons./23,24/

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- At build-out there would be an increase of 20.6 acres of tidal wetland beyond that for the year 2000. This acreage would be located in two areas along the eastern edge of the site, one between Piers 52 and 64 (Bayfront wetland) and one between the mouth of China Basin Channel and Pier 48. Each area would contain some open water, mudflats, salt marsh, and a vegetated island. These areas would be used by the same waterfowl and shorebird species described for mid-channel wetlands. This includes large waders such as herons and egrets. The new areas would support additional individuals of these species. Additionally, the new areas would be more protected from human disturbance than would the mid-channel wetland. This would increase their value to waterfowl and shorebirds over equivalent areas subject to human disturbance./23/ Assumed buffer zones of dense vegetation along the wetlands border would enhance the area by reducing intrusion by people and pets./24/ Because of its location near the mouth of China Basin and its size, the proposed wetland near Pier 48 would be superior in habitat value to the proposed wetland between Piers 52 and 64. Also, the shape of area near Pier 48 allows greater flexibility in wetland design and more opportunity for creation of an island and buffer area than either the mid-channel or Bayfront wetland.

  The existing sewage / stormwater outfalls may adversely affect shorebirds and waterfowl using the wetlands, particularly during overflow periods. The mid-channel wetland and, to a lesser extent, the China Basin wetland would be most vulnerable to sewage discharges. Effects could include reduced populations of prey species as a result of lowered dissolved oxygen levels in the water, lower plant productivity and increased incidence of disease among wildlife.

  Birds could be expected to move between and use all three wetland areas. Small mammals are less mobile and are expected to be more restricted to one wetland area. The lack of connections between the three wetlands would make small mammal movement between the wetlands difficult; large streets would be barriers to movement of some animals.

- Wetlands Context and Design

  Wetland habitats in the San Francisco Bay Region continue to be eliminated and altered./23/ Wetlands provide a continuity of habitat between the open waters of the Bay and upland areas. Wetlands increase the wildlife diversity by providing additional habitats, and by providing many of the animals' life history requirements (e.g., feeding, mating, and nesting) in one area. Tidal marshes provide habitat for invertebrates, which

• form an important link in the ecosystem of the Bay. The invertebrates are consumed by juvenile fish, waterfowl and shorebirds./23/ Creation of wetlands in the Project Area would add to the diversity of habitats and wildlife on-site and protect a diminishing natural wildlife community in the Bay Area. Increased diversity of wildlife species would add to the passive recreation opportunities and enjoyment of local residents. The creation of wetlands within Mission Bay, as proposed in Alternative B, is not required by BCDC fish and wildlife policies and those for marshes and mudflats, but would respond to BCDC policies. The proposed wetlands would serve to enhance the presence of wildlife, provide public benefits and augment the number of marshes existing in the Bay.

• In general, the larger and more contiguous the wetland, the greater the benefits would be for wildlife. A larger and possibly more diverse wildlife population could be supported by one large wetland in comparison to three small wetlands.

• In order for developed wetlands to better function as wildlife habitat, it would be desirable to maximize the width of the wetland in the elevation range between +2.5 and +4.0 feet NGVD (-6.1 and -4.6 San Francisco City Datum) which would be the appropriate elevations for a marsh plain. At least one of the islands should be at this elevation with high-tide refuge (Extreme High Tide is +6.7 feet NGVD or -1.9 San Francisco City Datum) areas for small mammals. The marsh plain would support the growth of common pickleweed, fleshy jaumea, and salt grass, three perennial plants capable of producing about 8,800 pounds per acre of plant tissue each year./24,24a/ This plant material would enter the Bay waters or be buried in the mud and serve as food for bacteria, fungi and small animals.

• The pickleweed may invade naturally and establish, but large amounts of natural invasion are not expected because there are few sources of seed or plant parts in the area. Planting of the marsh plain is recommended. Small sloughs cut through the salt marsh plain would provide feeding sites for great blue herons, great egrets, shorebirds, black-crowned night herons, and snowy egrets. The plain would be used also as a resting area for shorebirds, herons and egrets during flood tide and high tide while the mudflats are covered with tidal water.

• A second elevation range which should equal the marsh plain in extent is that between -2.5 and +1 feet NGVD (-11.1 and -7.6 feet San Francisco City datum). This is the elevation appropriate for San Francisco Bay mudflat which is very important in providing habitat for colonizing invertebrates such as the clams, worms, amphipods, detritus

- feeding snails, and tube worms./24b/ None of these animals is native, but they do account for the majority of the animal biomass in the mud of San Francisco Bay/24c,24d,24e/ and form the basis of the diets of many shorebirds and some fishes.

- Shorebird species which may feed on the mudflat and use the marsh plain for resting would include western sandpiper, short-billed dowitcher, American avocet, willet, marbled godwit, black-bellied plover, black-necked stilt, dunlin (or red-backed sandpiper) and semipalmated plover which are often abundant or very common on San Francisco Bay mudflats /24f,24g/ and in restoration sites /24h/.

- The transition between the marsh plain and the mudflat (elevation +1 to +2.5 feet NGVD, -7.6 to -6.1 feet San Francisco City Datum) may be a narrow zone and, therefore, have a steeper slope than the plain or the mudflat. This slope should be planted with California cordgrass, a tall grass which spreads by underground rhizomes binding together the naturally soft sediments of the zone. California cordgrass, once established, would shelter and provide cover and foraging habitat for birds such as the California clapper rail which feeds on ribbed mussels, clams, yellow shore crabs, and spiders./24/

- Due to the absence of rails in central San Francisco Bay north of Foster City, south of Richardson Bay and west of Emeryville /24i/, there may be no populations close enough to occupy the habitat. Higher areas with rock and mud or sand on islands may be used by killdeer, sandpipers and sanderlings./19,20,23/

- The shallow portions of the lagoon areas may be used by herons, egrets, dabbling ducks, and western and California gulls. Diving birds such as western and pied-billed grebes, cormorants and terns would fish the deeper water. Scaups and ruddy ducks may also use the embayment. Occasionally, harbor seals may swim about the lagoon and haul out on the islands.

- No substantial temporary impacts to wildlife from creation of the wetlands are expected, as the site currently receives little use.

Initial Phase of Development

Under Alternative B, there would be a total of 18 acres of open space and open water habitat, including the existing channel and 6.0 acres of landscaped open space in the initial phase of development. About 5.3 acres of the open space would be potentially usable as wildlife habitat. Edge treatment along the channel would include rock and wire gabion and wooden decking. Most of the existing shorebird feeding sites along the channel would be retained in the initial phase of development. Construction of the mid-channel wetland temporarily would disrupt birds in that area.

Alternative N

By the year 2020, there would be a total of 17.2 acres of open land suitable for wildlife habitat (see Table VI.D.15, p. VI.D.77). Park-like open space would comprise 5.2 acres, an increase of 1.8 acres over the open space in the year 2000. Twelve acres would be open water. The park-like open space would be a narrow linear band with limited wildlife value.

The park-like areas would provide habitat for urban, human-tolerant birds and mammals. The same assemblage of species expected to occur in this habitat under Alternative A is expected to occur under Alternative N. Alternative N would have 50 fewer acres of this habitat than would Alternative A. Thus, Alternative N would support fewer animals than Alternative A, but more than existing conditions provide. Shorebirds, herons and egrets would continue to use the "natural" shoreline of the channel for foraging as long as food is available.

• The shoreline of China Basin Channel would remain a mix of existing bank conditions (i.e., earthen with vegetation) and concrete rubble that would preserve existing shorebird feeding habitat along the channel./24j/ By comparison, Alternatives A and B would result in substantial changes to the existing conditions. Thus, Alternative N would not result in displacement of the individual birds and other animals using the banks at present. The open water habitat in Alternative N would be identical to that in Alternative A. Thus, the same species are expected to use the area as those described under Alternative A for the year 2000. Like Alternative A, increased human activity near the channel under this Alternative would substantially reduce or eliminate egret and heron use of the channel. The displaced individuals would forage in other parts of the Bay Area.

Approximately the same numbers of birds are expected to use the water areas under Alternative N as under Alternative A. Although more existing bank conditions would remain along the channel, there would be no adjacent open space. Thus, there would be more disturbance to birds along the channel from human activity under Alternative N than under Alternative A, even though total human activity in the Project Area is less under Alternative N.

AQUATIC LIFE

Alternative A

Under Alternative A, the aquatic environment would be most affected by any temporary changes in local water quality brought about by dredging of the China Basin Channel, and changes in non-point runoff patterns and characteristics. These changes would result in short-term effects on aquatic organisms described below. The greater amount of dredging in the initial phase of development would probably have the most effect on aquatic organisms. Lesser effects would occur in subsequent dredging near the banks up to the year 2000.

Dredging of China Basin Channel and disposal of dredged material at either an ocean or Bay disposal site would cause the suspension of fine particulate matter contained in the bottom sediments into the water column which, in turn, would elevate local turbidity levels. The degree of turbidity would vary substantially with the quantity and duration of the dredging, and would depend also on the type of dredging equipment used, quality of equipment and care of the operator. In all cases, the increased turbidity levels would be short-lived and generally confined to within a few hundred yards of the dredging activity. After initially high turbidity levels, sediments would disperse and background levels would be restored within a short time (hours) of dumping. The particulate materials associated with the turbidity would likely cause short-term disruption of feeding and respiration of resident invertebrates and of fishes unable to avoid or remove themselves from the area./25/ While some fish would die because of dredging, it is not likely that significant fish kills would result.

Under most conditions, the fish assemblage known to exist near the mouth of China Basin Channel most likely would not be affected by dredging. Turbidity plumes resulting from dredging would be dispersed relatively rapidly (probably within a matter of hours) and the particulate concentrations would be diluted to levels that would pose no significant threat to most fishes at the channel mouth or off China Basin in the Bay. However, if the two-month dredging operations were to coincide with the peak spawning season of Pacific herring (December to March), there could be local disruption of that fishery. Herring deposit large masses of eggs on aquatic vegetation and hard substrates such as rip-rap and pilings. Because of the adhesive nature of the surface of these eggs, clay particles, such as those suspended in the water column after dredging, stick to the eggs. Thus, the eggs usable as wildlife habitat. Edge treatment along the channel would include rock and wire gabion and wooden decking. Most of the existing shorebird feeding sites along the channel would be retained in the initial phase of development. Construction of the mid-channel wetland temporarily would disrupt birds in that area.

Alternative N

By the year 2020, there would be a total of 17.2 acres of open land suitable for wildlife habitat (see Table VI.D.15, p. VI.D.77). Park-like open space would comprise 5.2 acres, an increase of 1.8 acres over the open space in the year 2000. Twelve acres would be open water. The park-like open space would be a narrow linear band with limited wildlife value.

The park-like areas would provide habitat for urban, human-tolerant birds and mammals. The same assemblage of species expected to occur in this habitat under Alternative A is expected to occur under Alternative N. Alternative N would have 50 fewer acres of this habitat than would Alternative A. Thus, Alternative N would support fewer animals than Alternative A, but more than existing conditions provide. Shorebirds, herons and egrets would continue to use the "natural" shoreline of the channel for foraging as long as food is available.

The shoreline of China Basin Channel would remain a mix of existing bank conditions (i.e., earthen with vegetation) and concrete rubble that would preserve existing shorebird feeding habitat along the channel. By comparison, Alternative A and B would result in substantial changes to the existing conditions. Thus, Alternative N would not result in displacement of the individual birds and other animals using the banks at present. The open water habitat in Alternative N would be identical to that in Alternative A. Thus, the same species are expected to use the area as those described under Alternative A for the year 2000. Like Alternative A, increased human activity near the channel under this Alternative would substantially reduce or eliminate egret and heron use of the channel. The displaced individuals would forage in other parts of the Bay Area.

Approximately the same numbers of birds are expected to use the water areas under Alternative N as under Alternative A. Although more existing bank conditions would remain along the channel, there would be no adjacent open space. Thus, there would be more disturbance to birds along the channel from human activity under Alternative N than under Alternative A, even though total human activity in the Project Area is less under Alternative N.

AQUATIC LIFE

Alternative A

Under Alternative A, the aquatic environment would be most affected by any temporary changes in local water quality brought about by dredging of the China Basin Channel, and changes in non-point runoff patterns and characteristics. These changes would result in short-term effects on aquatic organisms described below. The greater amount of dredging in the initial phase of development would probably have the most effect on aquatic organisms. Lesser effects would occur in subsequent dredging near the banks up to the year 2000.

Dredging of China Basin Channel and disposal of dredged material at either an ocean or Bay disposal site would cause the suspension of fine particulate matter contained in the bottom sediments into the water column which, in turn, would elevate local turbidity levels. The degree of turbidity would vary substantially with the quantity and duration of the dredging, and would depend also on the type of dredging equipment used, quality of equipment and care of the operator. In all cases, the increased turbidity levels would be short-lived and generally confined to within a few hundred yards of the dredging activity. After initially high turbidity levels, sediments would disperse and background levels would be restored within a short time (hours) of dumping. The particulate materials associated with the turbidity would likely cause short-term disruption of feeding and respiration of resident invertebrates and of fishes unable to avoid or remove themselves from the area./25/ While some fish would die because of dredging, it is not likely that significant fish kills would result.

Under most conditions, the fish assemblage known to exist near the mouth of China Basin Channel most likely would not be affected by dredging. Turbidity plumes resulting from dredging would be dispersed relatively rapidly (probably within a matter of hours) and the particulate concentrations would be diluted to levels that would pose no significant threat to most fishes at the channel mouth or off China Basin in the Bay. However, if the two-month dredging operations were to coincide with the peak spawning season of Pacific herring (December to March), there could be local disruption of that fishery. Herring deposit large masses of eggs on aquatic vegetation and hard substrates such as rip-rap and pilings. Because of the adhesive nature of the surface of these eggs, clay particles, such as those suspended in the water column after dredging, stick to the eggs. Thus, the eggs are susceptible to smothering during high turbidity periods. Hatched fry are susceptible to smothering by fine suspended particulates during periods of high turbidity levels because they can cause gill abrasion, clogged gills, and suffocation. Loss of both eggs (roe) and fry could potentially reduce herring populations and reduce future catches for an indefinite period.

Contaminants associated with (bound to) the suspended sediments also may degrade water quality by reducing dissolved oxygen concentrations in the water column and leaching contaminants from the sediments. The mechanisms by which these affect water quality are discussed in VI.L. Hydrology and Water Quality, p. VI.L.24. Significantly depressed oxygen levels (i.e., below five mg/l) may cause respiratory stress to aquatic life and levels below three mg/l may cause acute mortality./26/ However, oxygen levels are not expected to remain low for long periods for two reasons. First, tidal flushing would be expected to ameliorate depressed oxygen levels by introduction of oxygenated water into the channel. Second, dredging of anoxic (oxygen poor) sediments would proceed for a short period of time. In summary, it is likely that the aquatic life would experience respiratory stress from dredging, but high mortality is not expected to result from depressed oxygen levels.

Some contaminants may be released from the sediments and become biologically available to organisms in the water column. The extent of their availability and impact to the biota depend on ambient water conditions at the time of release and the biological condition of the target organisms. Potential impacts could include direct mortality or non-lethal physiological effects such as damage to reproductive or respiratory organs. In addition to water column impacts, there is the potential for bottom-dwelling organisms to bioaccumulate contaminants from the sediments; that is often of more concern than release of chemicals to the water column following dredge material disposal of contaminated sediments. More definitive analysis of the effects to the aquatic community resulting from any release of contaminants from the sediments would require toxicological testing. Provisions for this type of testing are included in recently proposed changes to the U.S. Army Corps of Engineers testing procedures for Section 404 discharges (Clean Water Act). These tests or other similar ones would be required prior to any dredging permits (see discussion in VI. L. Hydrology and Water Quality, p. VI.L.25.)

The benthic community within China Basin Channel is dominated by mollusks and polychaete worms./27/ As a general rule, the presence of a limited number of taxonomic groups and individuals, and dominance by an individual group are characteristic of stressed or disturbed subtidal soft-bottom environments. The dominance of polychaete worms and mollusks suggests that the channel's benthic infaunal (bottom-dwelling organisms) community is stressed. The rate at which this already stressed benthic community would recover after cessation of dredging would be variable and unpredictable. If it is assumed that the underlying substrate is of the same grain size and physical characteristics as the dredged sediment, then the recolonizing benthic community may be similar to the existing community. As the channel would be dredged approximately once every ten years, the benthic community would be able to reach a relatively mature successional stage before extensive recolonization would have to occur. Dredging in the channel could benefit the benthic community by improving water circulation and quality, enabling greater numbers (both number of species and number of individuals of a given species) of organisms to exist there. Any benefit or detriment to water quality would depend on the final character of the channel dredging.

Sewage overflow at the Division Street outfall would continue to limit the environmental conditions for aquatic biota. As changes in land use occur in the project area, non-point source inputs to the channel, such as urban runoff, would also change. Impacts to aquatic organisms may include bioaccumulation of anthropogenic substances such as tars, oils, fuel, in the form of polycyclic aromatic hydrocarbons (PAHs), deposited on streets by increased vehicular traffic in the Project Area and collected by sewers and included in the sewer system.

Along the channel, the gabions, decking, and T-wall may serve as additional substrate for encrusting organisms such as barnacles, algae, sponges, anemones, etc. These structures also may provide feeding and cover habitat, not readily available at present, for gobies, sculpins, and other small fishes.

The status of the aquatic environment at full build-out would depend on the ambient water quality conditions in the China Basin Channel between the period of initial dredging and conditions in 2020. Assuming that the water quality has not been significantly degraded beyond present conditions, the benthic infauna would have recovered from the initial dredging event (and any subsequent maintenance dredging episodes) and recolonized the area. Intertidal and subtidal invertebrate communities would have established themselves on the physical structures in place along the channel's edge.

Initial Phase of Development

Alternative A includes wet dredging of approximately 45,000 cubic yards of sediment from China Basin Channel in the initial phase of development. No change in channel configuration is proposed. A small amount of additional dredging along the banks probably would occur in conjunction with construction of shoreline gabions and wooden decking up to the year 2000. Those would occur on the south side of the channel in its eastern half between Fifth and Third Streets. The wooden decking would provide more habitat value (e.g., places for hiding and feeding) for aquatic organisms than would gabions.

Alternative B

Under this Alternative, dry dredging (excavation) is proposed to create a potential wetlands along the southern shoreline of the channel (mid-channel site) by the year 2000, and the China Basin and Bayfront wetlands by build-out. However, a small amount of wet dredging would occur when the connection between the created wetlands and the channel is excavated. The majority of the historical wetlands and marshes in the San Francisco Bay region have been destroyed. Wetlands are used extensively as nursery grounds for many commercially and recreationally important fish species, such as topsmelt, northern anchovy, striped bass, and surfperches. Those species are important to the diets of waterfowl and shorebirds. There would be a net benefit to these fisheries if wetlands were established at Mission Bay. If, however, in constructing the wetland, the connection to the channel were made during the peak spawning season of the Pacific herring, potentially significant impacts to this species could occur.

The proximity of the mid-channel site to existing and probable future human activity (with consequent human and domestic pet disturbances and predation) and the narrowness of the site make this location less desirable for wetlands development then the site east of Third Street at China Basin proposed for wetland development in the year 2000. Also, tidal flow may not be adequate to flush the wetland sufficiently, and the water quality in the channel at the mid-channel site may be below that which is necessary for establishment of healthy biological communities.

Due to the limited amount of available information about current soil types, grain size, groundwater flow and quality, water and sediment quality, best- and worst-case scenarios are considered in evaluating the potential impact of wetland creation. Under the best-case scenario, it is assumed that all sediments and soils at the mid-channel wetland site are not contaminated at levels below which a hazard exists for aquatic organisms. The substrate of the dredged channel is assumed to be largely uncontaminated fill. It is also assumed that there has been no groundwater contamination from leaking storage tanks and little or nor contamination of surficial soils. It is further assumed that the water quality of China Basin Channel would not be degraded. It is likely that under this scenario there would be removal of at least some surficial soil and a small amount of channel sediments at the time the wetland lagoons are opened to the adjacent water bodies.

Species diversity and usage would be enhanced where the tidal wetland is designed such that channel configurations create slow velocities of water movement and the banks are gently sloped, thus creating mudflat zones. Habitats would be developed that are favorable for the establishment of food sources such as plants, benthic invertebrates (such as polychaete worms and clams) and fishes (such as topsmelt, three-spine stickleback and juvenile fishes).

Initially, the newly developed tidally inundated area would be devoid of benthic life. Colonization, succession rates and community structure of the benthic infauna cannot be accurately predicted. Factors affecting colonization success include the grain size of newly exposed sediments; physical stability of the substrate; contamination levels of the sediments; food availability; and water circulation and quality. Some fish species which may come into the wetland would follow the tidal cycles in their distribution, i.e., enter at high tide and disperse to other areas at low tide. Juvenile and adult fishes such as three-spine sticklebacks, gobies, and sculpins would remain only in areas close to the wetland that are constantly submerged. Deep channels in the wetland habitat would become vegetated by vascular plants or algae, thereby reducing water velocities and creating diverse habitats for fish breeding, egg, and larval development./28/

The worst-case scenario considers the same conceptual wetland design but assumes that contaminated soil and rubble and polluted water conditions exist. Development of the proposed mid-channel wetland site under such conditions would be difficult. This scenario assumes that sediments and soils have been substantially contaminated by past land uses, e.g., the hazardous waste shipping terminal along the southeastern shoreline of the channel and railroad facilities, and by indiscriminate dumping of industrial and/or hazardous waste materials on land and into China Basin Channel. The scenario assumes that underground storage tanks scattered throughout the Project Area, and in particular the tank at the mid-channel wetland site, may have leaked into the groundwater, thereby contaminating groundwater seeping into the wetland areas. Under this scenario, removal of surficial soil and the upper layer of channel sediments would not adequately produce soil and groundwater conditions conducive to reestablishment of terrestrial and aquatic ecosystems or creation of new wetlands. Sediments and ground surfaces are assumed to be of inappropriate particle size for colonization of desired invertebrates and plants. Disposal of any contaminated materials excavated during dry dredging would not be considered for aquatic disposal, but would rather require upland disposal or treatment.

In the worst-case scenario, it would be difficult to develop any of the wetlands because of the inadequacy of the physical parameters to support healthy and viable wetland communities. The soils and water may contain contaminants that are limiting factors to vegetation, concentrate to toxic levels in organisms, cause genetic damage or result in other adverse effects. Illegal dumping of trash and pollutants may exacerbate the problem. The wetland sites could become little more than a mudflat or low-lying area occupied by weeds and plants of little habitat value. This could happen if the elevations of the created wetland do not allow adequate tidal exchange (or fresh water seepage) or the soils are too saline. The wetland must be engineered in such a way to overcome the physical problems of the site and allow wetland development. Such remedial measures may prove costly: these could entail removal of the entire 15 to 30 feet of fill and possibly some of the underlying mud and either remediation of that material or replacement with clean fill./29/

If the water quality is maintained or improved and the area is kept free of debris, the mid-channel wetland area created in 2000 would have become fully established by build-out, benthic infauna may reside in the deeper, tidally inundated areas and fish uses would be prevalent. The presence of a mature wetland would likely enable a greater diversity and abundance of aquatic organisms to survive there than in the year 2000. As noted previously, wetlands are used extensively as nursery grounds for many commercially and ecologically important fish species, which are, in turn, preyed upon by a variety of waterfowl and shorebirds. The wetland would also provide an important educational experience for many people who would otherwise not have seen a wetland at close range./30/

Two new wetland areas would be constructed by the year 2020, one on the southeastern shoreline of China Basin Channel between Piers 48 and 50 (China Basin wetland) and the other between Piers 54 and 64 on the southern bayfront of the Project Area (bayfront wetland). Among the three wetland sites, the China Basin wetland would be the most beneficial for aquatic organisms. The most southern wetland site, between Piers 54 and 64, would provide a new area of limited habitat for aquatic organisms. The China Basin and bayfront wetlands would be generally superior to the mid-channel wetland in habitat value due, in part, to better tidal circulation and flushing. Best- and worst-case scenario assumptions made above for the mid-channel wetland site discussion would also be applicable to the other two wetland sites.

Initial Phase of Development

Alternative B includes a small amount of modification of the edges of the channel in order to install edge treatments and no dredging of the China Basin Channel except for possible occasional maintenance dredging necessary to accommodate boat travel. In the initial phase of development, this would occur near the head of the channel at the pump station and along the south side of the channel near Owens Street. The shoreline edge treatments are similar in kind to those in Alternative A and would provide similar substrate and habitats, as discussed previously.

Alternative N

Under this Alternative, China Basin Channel would remain in much the same condition as now exists. Without dredging or development of edge treatments or wetlands, the channel would continue to exhibit low diversity in the benthic community.

MITIGATION

TERRESTRIAL AND WETLAND VEGETATION/WILDLIFE

Measure	Alternative	Description
M.1	A	Provide more large continuous blocks of open space and parklands in Alternative A. Small, narrow and disjunct patches of habitat support fewer animals than do large contiguous blocks. Several narrow strips of open space in the Alternative are located along the east ends of Fourth Street and Alameda Street, and along 16th Street extending northwest to the channel. Providing an equivalent acreage of open space adjacent to the planned open space along the channel would provide more valuable habitat for wildlife than would be provided in the narrow strips. Narrow strips of habitat can serve as movement corridors for wildlife when they connect large blocks of habitat. The narrow habitat strips do not serve this function as they are currently designed. To provide better connectivity of habitats, create wider strips of open space planted with vegetation types useful to wildlife between the larger open areas.
M.2	A,B,N	Establish vegetation as soon as possible after commencement of construction to maximize the length of time the habitat is available. Trees and shrubs would be larger and more mature by build-out, than they would if planting were delayed.
M.3	A,B,N	Plant fruit, nut and berry producing trees and shrubs in open space areas to increase the primary productivity of the site, providing food for birds.
• M.3a	A,B,N	To the maximum extent practicable, use organic controls on pests and weeds in terrestrial landscaping. Avoid use of pesticides and herbicides known to create adverse effects on birds. Prepare a list of chemical pesticides and herbicides to be avoided by park personnel and property owners of Mission Bay.

Measure	Alternative	Description
M.4	A,B,N	Plant foliage buffers between open space areas and roadways and areas of high human activity to provide more tranquil open areas and decrease disturbance to animals. Native plants should be employed in this planting to the maximum extent possible.
• M.5	B	The wetland sites would enhance the marginal wetland area currently located along the banks of China Basin Channel, as well as provide expanded wetland habitat opportunities in the Project Area. Wildlife values could be increased further by providing contiguous unbroken blocks of open space and wetland habitats by consolidating areas as described in the following measures:
M.5a		In lieu of developing the 13.2-acre mid-channel wetlands, develop at least 13.2 acres of wetlands adjacent to the proposed China Basin wetlands which has been identified as the preferred area for wetlands development in the Project Area./30/ That could be done partially along the channel and partially south of the China Basin wetlands. This would require an adjustment of the adjacent land uses currently envisioned for this Alternative.
M.5b		Develop the mid-channel area currently proposed as wetlands as park-like open space.
M.5c		Eliminate the proposed Hooper Street between the proposed open space and the channel.
M.5d		In lieu of developing seven acres of bayfront wetlands between Pier 54 and Pier 64, develop an additional seven acres of wetlands continuous with the China Basin wetlands at the Banana Triangle. This would require an adjustment of the adjacent land uses currently envisioned for this Alternative.
M.5e		In conjunction with M.5d, eliminate the proposed Daggett Street east of Fourth Street.
• M.5f	A,B,N	Develop wading bird and shorebird habitat along the channel that is equivalent to or greater than the existing areal extent of that habitat. Planting in the area would need to include pickleweed (*Salicornia virginica*) and monitoring by a biologist for at least seven

Measure	Alternative	Description
•		years. The biologist would report to the San Francisco Office of Environmental Review yearly on the amount of cover the plants achieve. It is expected that in three years, the pickleweed would attain a cover of more than 50%. This means that in randomly selected sample areas, the plant canopy would cover more than 50% of the bare mud.
• M.5g	A,B,N	To ensure minimal displacement of individual birds, phase development of wetlands under Alternative B and habitat under Alternatives A, B, and N so that existing individual birds would have places to use on-site while wetlands are being developed.

To help ensure successful creation of wetlands within the Project Area, consider the following design and construction measures (M.6–M.12)./30/ The measures are preliminary and would require refinement during preparation of a detailed design for the wetland.

M.6	B	Remove existing debris/fill in proposed wetland areas to an elevation at least 2 to 3 feet below the desired elevations of marsh restoration and then completely capped with clean dredge spoils./30/ These spoils should preferably have a high (greater than 90%) silt and clay content.
M.7	B	Enclose restoration areas by a "hard edge," e.g., a concrete retaining wall, which could also support a pedestrian footpath./30/ With a retaining wall of sufficient height (e.g., +10 feet NGVD or +1.4 San Francisco City Datum) it may be possible to keep any potentially contaminated groundwater out of the wetland area as well as provide a means to discourage human disturbance directly within the wetland. Such a hard edge would allow the entire outside perimeter between the water and the footpath to be developed as a wetland because it would not be necessary to take the slope gradually up to the elevation of adjacent open space areas. A wall would, however, cause some shading at its immediate base.

Measure	Alternative	Description
• M.8	B	To maximize opportunity for education and observation of the wetland, provide educational displays along the footpath at the edge of the wetland. An observation tower could also be provided to allow an overview of the wetland and for observing bird life. However, public access should be designed to prevent intrusion into the wetland. Specific measures that should be taken to achieve this include: constructing a fence between the footpath and the wetland high enough to prevent people from easily jumping or stepping over it, and planting upland vegetation along the wetland/footpath interface in a "buffer zone," dense enough to discourage through traffic. The fence should be of a fine mesh to prevent domestic animals from moving through it into the wetlands. The park signs should discourage high-activity sports along the marsh footpath.
M.9	B	Level the design slope above the elevation of +2.8 feet NGVD (-5.8 feet San Francisco City Datum) to maximize the pickleweed zone within the wetland./30/ The elevation should be gradually increased to about +4 feet NGVD (-4.6 feet San Francisco City Datum) near the wall to enable a more natural appearing salt marsh to develop. At the base of the wall, heap sediment and upland soil to simulate a levee or place pilings to resemble a ruined wharf. Either of these constructs would function as refuge for small mammals and birds during the highest tides.
M.10	B	Grade islands to an elevation of +6 feet NGVD (-2.6 feet San Francisco City Datum)./30/ That would provide protected nest sites for birds and a refuge from high tides for small mammals.
M.11	B	Plant marsh areas with: 1. California cordgrass, *Spartina foliosa*, between +1 and +2.5 feet NGVD (-7.6 and -6.1 feet San Francisco City Datum).

Measure	Alternative	Description
		2. Pickleweed, Salicornia virginica, Juamea, Juamea carnosa, and salt-grass, Distichlis spicata, between +2.5 and +4 feet NGVD (-6.1 and -4.6 feet San Francisco City Datum). Proportions should be 80% pickleweed, 10% jaumea, and 10% saltgrass.
		3. Gumweed, Grindelia humilis, and salt marsh lavender, Limonium californicum between +4 and +5 feet NGVD (-4.6 and -3.6 feet San Francisco City Datum).
		4. Fat-hen, Atriplex patula ssp. Hastata, Australian saltbush, A. semibaccata, and coyote brush Baccharis pilularis, between +5 and +6 NGVD (-3.6 and -2.6 feet San Francisco City Datum)./24/ This will provide immediate vegetative growth in the marshes. Natural seeding is expected to be unreliable due to distance from seed sources./30/
•		5. Coast live oak (Quercus agrifolia), toyon (Heteromeles arbutifolia), coyote brush (Baccharis pilularis var. consanguinea and B. p. "twin peaks"), sandbar willow (Salix Hindsiana), dune tansy (Tanacetum sp.), St. Catherine's lace (Eriogonum giganteum and E. arborescens), Pacific wild rye grass (Elymus pacificus), paintbrush (Castilleja sp.), and seeds of California poppy and lupine between +6 feet NGVD (-2.6 feet San Francisco City Datum) and the crests of the berms and knolls which surround the wetland.
• M.12	B	Construct the wetlands islands with clean dredge spoils below +4 feet NGVD (-4.6 feet San Francisco City Datum) and clean upland soil above +4 feet NGVD to provide a viable substrate for plant growth./30/
M.13	B	As part of the detailed design for the wetlands, set criteria for measuring the success of its establishment. Monitor wetlands on a six-month basis to ensure development of marsh vegetation. If plant survival and growth do not meet the set criteria, then remedial action should be taken. Such action may include re-assessment of the site and the goals of the wetlands and, if necessary, re-design and replanting of the site.

Measure	Alternative	Description
AQUATIC LIFE		
M.14	A,B	Limit wet dredging operations, including opening of lagoon at China Basin wetland under Alternative B, to between the months of March and November to eliminate any potentially significant impact of dredging on the Pacific herring fishery.
M.15	B	To establish and protect wetlands within the Project Area, conduct soil sampling of proposed restoration areas. That must occur before dry dredging or planting occurs so that the extent of any site-specific contamination and its potential for impacts to aquatic life can be determined, and the level of necessary clean-up or other mitigation established, as described for soils contamination in VI.N. Hazardous Wastes, beginning on p. VI.N.27.
M.16	B	To minimize shoreline erosion, construct the wetlands with gently sloping banks. Such a measure would reduce the probability of colonization by Sphaeroma quoyana, a destructive burrowing isopod that has been suspected of causing erosion of banks./27/

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NOTES

SETTING

/1/ Nichols, D. R., and N.A. Wright, Preliminary Map of Historic Margins of Marshland, San Francisco Bay. Open-File Report 71-0216, U.S. Geological Survey, 1971, 10 pages.

/2/ CH$_2$M Hill Engineers, Emeryville, California, Mission Bay Study, prepared for Jefferson Associates, Inc., San Francisco, 1983.

/3/ Constance, L., "Frittilaria liliadea Rare Plant Status Report," California Native Plant Society, 1977.

• /4/ Rick York, Botany Research Assistant, California Natural Diversity Data Base, Sacramento, telephone conversation, October 20, 1986.

/5/ California Native Plant Society, "Inventory of Rare and Endangered Vascular Plants of California," Special Publication No. 1 (Third Edition), 1984.

/6/ Brock, Thomas D., Biology of Microorganisms, Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 802 pages, 1979.

/7/ Censuses were conducted on foot, providing 100% coverage of the study area. Censuses were conducted between 11:00 a.m. and 3:00 p.m., requiring two hours each to complete. Binoculars and a spotting scope (20x) were used. All birds and mammals were identified to species, except for the Western Grebe/Clark's Grebe complex. Censuses were conducted only on days of optimum viewing conditions (i.e., no or light wind, 55-65°F, generally fair skies).

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/9/ Laudenslayer, W.F., Jr. and W.E. Grenfell, Jr., editors, "A List of Amphibians, Reptiles, Birds, and Mammals of California," Outdoor California, 44(1):5-14, 1983.

/10/ CH$_2$M Hill Engineers, Bayside Overflows, report for City and County of San Francisco, 1979.

/11/ Philip Williams and Associates, Preliminary Analysis of Circulation Design for Mission Bay Project, San Francisco, 1986.

/12/ Anaerobic conditions refer to the state of an environment in which organisms live or grow with little or no atmospheric oxygen. The organisms typically obtain their oxygen by decomposing compounds containing oxygen.

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/16/ Robert Tasto, California Department of Fish and Game, interview, October 21, 1986.

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/17/ San Francisco Bay Conservation and Development Commission, San Francisco Bay Plan, adopted January 1969, amended July 1979.

/18/ Martin, A. C., H. S. Zim and A. L. Nelson, American Wildlife and Plants, A Guide to Wildlife Food Habits. Dover Publications. New York, 1951.

/19/ Verner, Jared, and Allan S. Boss, technical coordinators, "California Wildlife and Their Habitats: Western Sierra Nevada." Gen. Tech. Rep. PSW-37, 439 p., illus. Pacific Southwest Forest and Range Experiment Station, U.S. Department of Agriculture, U.S. Forest Serv., U.S. Dep. Agric., Berkeley, California. 1980.

/20/ McCaskie, G., P. De Benedictis, R. Erickson and J. Morlan, Birds of Northern California, An Annotated Field List, Second Edition. Golden Gate Audubon Society, Berkeley, California. 84 p. 1979.

/21/ Ingles, L. Mammals of the Pacific States. Stanford Press, Stanford, California. 506 p. 1965.

/22/ Stebbins, R. C. A Field Guide to Western Reptiles and Amphibians, Second Edition Revised. Houghton Mifflin, Boston. 336 p.

• /22a/ The definition of wetlands from the Corps of Engineers (COE) (Federal Register 1982) and the Environmental Protection Agency (EPA) (Federal Register 1980) is "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." The three characteristics that the COE uses as diagnostic of wetlands are: 1) vegetation - prevalent vegetation consists of species of plants placed by the U.S. Fish and Wildlife Service (USFWS), COE, EPA and the Soil Conservation Service (SCS) on the "National List of Plants that Occur in Wetlands," published by the USFWS. Pickleweed is not only on the list but is listed as "obligate," i.e., a plant that occurs in wetlands with a frequency greater than 99%; 2) hydric soils - soils are flooded or saturated for a long enough period of time to develop anaerobic conditions; and 3) hydrology - soils are regularly inundated or saturated.

• /22b/ This policy was developed in response to Senate Concurrent Resolution 28, in which the state legislature, in recognition of the importance of wetlands, indicates its intent "to preserve, protect, restore and enhance California's wetlands and the multiple resources which depend upon them for the benefit of the people of the State." The legislature further declared its desire that wetland habitat acreage be increased by 50% by the year 2000.

• /22c/ Don Lollock, Chief, Environmental Services Division, California Department of Fish and Game, "The Wetlands Policy - Interpretation and Implementation," presented to the Association of Environmental Professionals Conference, May 6, 1988, Sacramento, California.

• /22d/ San Francisco Department of City Planning, San Francisco Master Plan, Environmental Protection Element, adopted July 9, 1987, pp. 1.6.10-1.6.11.

/23/ San Francisco Department of City Planning. "Wetlands/Playfields," Special Study for Mission Bay, prepared by Danadjieva and Koenig Associates, 1986.

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• /24d/ Nichols, F.H., and M.M. Pamatmat, "The Ecology of the Soft-Bottom Benthos of San Francisco Bay: A Community Profile," prepared for U.S. Fish and Wildlife Service, Washington, D.C., 1988.

• /24e/ Niesin, T.M., and E.B. Lyke, "Benthic Colonization" in T. Niesin and M. Josselyn, editors, The Hayward Regional Shoreline Marsh Restoration: Biological Succession During the First Year Following Dike Removal, Department of Biological Sciences, San Francisco State University and Tiburon Center for Environmental Studies, 1981.

• /24f/ Storer, R.W., "The Seasonal Occurrence of Shorebirds on Bay Farm Island, Alameda County, California," The Condor 53:186-193, 1951.

• /24g/ Recher, H.F., "Some Aspects of the Ecology of Migrant Shorebirds," Ecology 47:393-407, 1966.

• /24h/ Cogswell, H.L. "Populations of Birds Using New Tidal Lagoons Compared to an Outer Tidal Flat on San Francisco Bay at Hayward, California," in T. Niesin and M. Josselyn, editors, The Hayward Regional Shoreline Marsh Restoration: Biological Succession During the First Year Following Dike Removal, Department of Biological Sciences, San Francisco State University and Tiburon Center for Environmental Studies, 1981.

• /24i/ Harvey, T.E., "California Clapper Rail Survey, 1978-1979," Job Final Report, Job V-1.8, Project E-W-3, California Department of Fish and Game, Sacramento, California, 1980.

• /24j/ Some of the concrete rubble on port property is the subject of a BCDC enforcement action and could potentially be removed as a result of that case; this is not a high priority for BCDC. Diane Penny, Permit Analyst, San Francisco Bay Conservation and Development Commission, telephone conversation, May 18, 1989.

/25/ Pequegnat, W.E. An Assessment of the Potential Impact of Dredged Material Disposal in the Open Ocean. U.S. Army Engineers Waterways Experiment Station. Technical Report D-78-2. Chief of Engineers, U.S. Army, Washington, D.C. 1978.

/26/ U.S. Environmental Protection Agency. Quality Criteria for Water 1986. Office of Water Regulations and Standards, Washington, D.C. EPA 440/5-86-001. 1986.

/27/ City and County of San Francisco, "Bayside Overflows," prepared by CH_2M Hill Engineers, 1979.

/28/ Josselyn, Michael and James Buchholz. Marsh Restoration in San Francisco Bay: A Guide to Design and Planning. Technical Report #3. Tiburon Center for Environmental Studies, San Francisco State University. 104pp. 1984.

/29/ Grading to a depth of 30 feet could present the most conservative situation. It is possible that grading could be reduced by excavation of the lagoon bottom only somewhat deeper than the final grade level. Migration of toxins present in the underlying sediments into the water could be prevented by placement of impermeable materials such as impervious textile barriers and capping with several feet of clean fill. Whether such a system would ensure establishment of a viable plant community cannot be determined at this time. The textile barrier would have to be a strong material that would remain impervious for a long period. The overlying clean sediments probably would have to be at least four feet thick to ensure rooting of vegetation, and measures would have to be taken to protect the cap from erosion. This may present a more cost-effective solution to grading and protection of the marsh from contaminated sediments, but in the long run, it may not present a permanent solution to the problem and certainly would not eliminate the potential hazards.

/30/ Cuneo, K., "Feasibility Study, Wetland Habitat Creation at the Mission Bay Project Site," prepared for Environmental Science Associates, Inc., 1987.

N. HAZARDOUS WASTES

SETTING

This section describes from several perspectives the potential for hazardous waste contamination and deposits to be found in the Project Area. The first subsection describes the regulatory framework for hazardous waste. The second section describes the progression of land filling and current knowledge, obtained mostly through recent borings, of the composition of the fill. The third subsection describes underground hazardous materials storage facilities known or suspected to be in or adjacent to the Project Area. Following discussion of underground facilities, the fourth subsection describes major types of historic industries that may have used hazardous materials or generated hazardous wastes. The fifth subsection deals with similar conditions for existing industries, including those uses that have the potential to affect public health adversely. The sixth subsection is a description of current surface conditions that might indicate the presence of hazardous waste deposits or soil contamination by hazardous materials.

Because past and present land uses adjoining the Project Area could result in surface or subsurface contamination, or affect public health inside the Project Area, adjoining lands within one city block (or for current industries those within about 2,000 feet) of the Project Area are included in this analysis. Those uses, activities or conditions outside the Project Area, however, are identified as such.

REGULATORY FRAMEWORK

San Francisco Fire Code

Article 29, added in January 1984, established a comprehensive system for processing permits, and for monitoring the use and disposal of hazardous materials (see discussion of this Article in Appendix L. Hazardous Wastes, p. XIV.L.1). The ordinance also established specific design and construction standards for underground storage tanks. The ordinance outlines provisions for handling abandoned hazardous waste storage facilities, as well as for maintenance of existing facilities.

Persons owning, leasing, or renting property who have reason to believe that an abandoned storage facility is located on their property must identify such a facility within six months of such knowledge. If an abandoned storage facility is identified, a plan for closing or upgrading the facility must be filed within 30 days. Any person who stores hazardous materials is responsible for the clean-up of any unauthorized or uncontrolled releases. The responsible party is required to clean up any unauthorized or uncontrolled releases, whether sudden or gradual. The provisions of this ordinance apply also to any establishment or storage facility owned or leased by the state or federal government. Ordinance No. 443-86, also known as the Underground Tanks Ordinance, amended Article 29 of the Fire Code and Article 21 of the Health Code to transfer authority for hazardous materials regulation from the Fire Department to the Department of Public Health (per the addition of Article 21 of the San Francisco Public Health Code).

San Francisco Public Works Code

- Article 20 was added by Ordinance No. 253-86 ("Analyzing the Soil for Hazardous Wastes," adopted June 27, 1986, and amended in August, 1988; also known as the hazardous soils analysis ordinance) to require a site history and soil analysis for building permits on properties in designated portions of the City suspected of being contaminated with hazardous wastes. The ordinance applies only to proposed work that would involve disturbance of more than 50 cubic yards of soil within designated City areas, on properties that have not been continuously zoned for residential uses since 1921. The hazardous soils analysis ordinance is discussed in Appendix L. p. XIV.L.8.

- The designated portions of the City include property located bayward of the original high tide line as indicated on a map of San Francisco, available from the Department of Public Works; the entire Project Area is included in this designated area. Other areas may be subject to the provisions of the ordinance if designated by the Director of Public Works (DPW). Pursuant to DPW regulations, the site history must include properties within 100 feet of the perimeter of the proposed excavation area. The hazardous soils analysis ordinance and regulations require that a history of the site proposed for disturbance be prepared by a person or persons with experience in hazardous waste, San Francisco history, and engineering or geology; that the soil be sampled by a registered engineer or engineering geologist or certified laboratory; and that the soil samples be analyzed by a certified laboratory for the presence of hazardous materials. The site history and soil analysis must be submitted to the Directors of Public Works and Public Health prior to issuance of the building permit application. If hazardous waste is found in the soil samples, the applicant must submit a site mitigation, or clean-up, plan. Once site clean-up is completed, the appropriate certification is submitted to the Director of Public Health. The building permit application will then be deemed complete, and the application will be considered by the City.

San Francisco Bay Regional Water Quality Control Board (RWQCB)

The RWQCB is required to ensure adequate protection of water quality and statewide uniformity in siting, operation, and closure of waste-disposal sites in the San Francisco Bay Area. The RWQCB's participation in the regulation of hazardous wastes includes classifying all proposed or current waste disposal sites in the district, and reviewing and determining the adequacy of facility closure and maintenance plans submitted to the California Department of Health Services (DOHS), in regard to protection of water quality.

In 1983, the Cortese Bill (Assembly Bill 2013) established a state-wide inventory of underground tanks and designated the State Water Resources Control Board (SWRCB) as the implementing agency. In 1984, amendments to the federal RCRA (see discussion of EPA on p. VI.N.4) mandated such inventories, and the SWRCB was designated as the state agency to administer this federal EPA program. The RWQCB maintains a list of registered underground storage tanks at the direction of the SWRCB, and leaking underground storage tanks must be reported to the RWQCB. Owners of new tanks must notify the RWQCB within 30 days of installation. Permitting of underground storage tanks in San Francisco is done by City and County agencies, under the direction of the RWQCB.

Department of Health Services

The Department of Health Services (DOHS) is the primary state agency regulating public health, including hazardous materials and wastes. Because the Project Area has a long history as an industrial area (see The Origins and Evaluation of a Pioneer Industrial Area, mid-1860s to 1900 in VI.J. Cultural Resources, beginning p. VI.J.4, and Site History, p. VI.N.5), it is possible that hazardous wastes exist in Mission Bay, and that portions of the Project Area would fall under the regulatory jurisdiction of DOHS. Under Title 22, Division 4, Chapter 30 of the California Administrative Code, Hazardous Waste Control Law of 1972 (HWCL), DOHS is empowered to manage hazardous wastes by regulating generators, transporters, and disposers of materials defined as hazardous wastes (see discussion in Appendix L. p. XIV.L.5). A generator, defined as a person whose act or process produces a hazardous waste or whose act first causes a material to become subject to regulation, is obligated to determine if a waste is hazardous (and to determine if wastes do, in fact, exist on the generator's property). Through its Uniform Hazardous Waste Manifest, DOHS ensures that generators, transporters, and disposal sites all conform with existing regulations.

The DOHS is also empowered by the EPA to administer the federal Resource Conservation and Recovery Act (RCRA) within California. Although the two laws are very similar in many respects, the state's Hazardous Waste Control Law (HWCL) differs somewhat from RCRA, in that the HWCL clearly assigns to the generators of hazardous wastes the primary duty for safe disposal. The HWCL also puts greater emphasis than RCRA on recycling of wastes to reduce the need for land disposal. Regulations under HWCL are generally more stringent than under RCRA. HWCL and RCPA are discussed in Appendix L. pp. XIV.L.5 and XIV.L.2, respectively.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) is the primary federal agency involved in regulating hazardous materials and hazardous wastes. Created in 1970 to coordinate federal environmental programs and enforce federal environmental regulations, EPA is charged with administering the Resource Conservation and Recovery Act of 1976 (as amended by the Hazardous Solid Waste Act of 1984, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or "Superfund"), and the Superfund Amendments and Reauthorization Act of 1986 (SARA) - see the discussion of those acts in Appendix L. p. XIV.L.1).

RCRA, as it is known, is a prescriptive statute that created a major new federal hazardous waste regulatory program. RCRA prohibited open dumping, established definitions of hazardous wastes, and established requirements for transportation, treatment, storage, and disposal of such materials. Its 1984 amendments severely limited land disposal, set a 1990 deadline for promulgation of land disposal restrictions for all hazardous wastes, and established regulations for existing and new underground storage tanks containing hazardous materials. RCRA is implemented by Title 40, Parts 260-271 of the Code of Federal Regulations. As with its other programs and regulations, EPA is committed to delegating its responsibilities in the areas of hazardous wastes and underground storage tanks to state (DOHS, SWRCB) agencies.

If portions of the Mission Bay site were found to be contaminated with hazardous wastes, they would become subject to the federal RCRA regulations, as well as parallel state regulations. Of particular importance are Part 261, "Identification and Listing of Hazardous Wastes," Part 262, "Standards Applicable to Generators of Hazardous Wastes," and Part 264, which describes required clean-up levels. EPA is revising the clean-up standards; the revised standards are expected to be more stringent.

CERCLA and SARA, as they are known, are respectively the original federal Superfund (1980) and the Superfund amendments and reauthorization (1986). Those Acts provide the EPA with authority to investigate hazardous substance releases, to clean up sites on the basis of EPA's Hazard Ranking System, to create funds for site remediation and victim compensation, and to determine rules of liability which favor compensation. SARA also focuses on the need for emergency preparedness and "community right-to-know," which relates to the community's access to hazardous waste information on industrial processes.

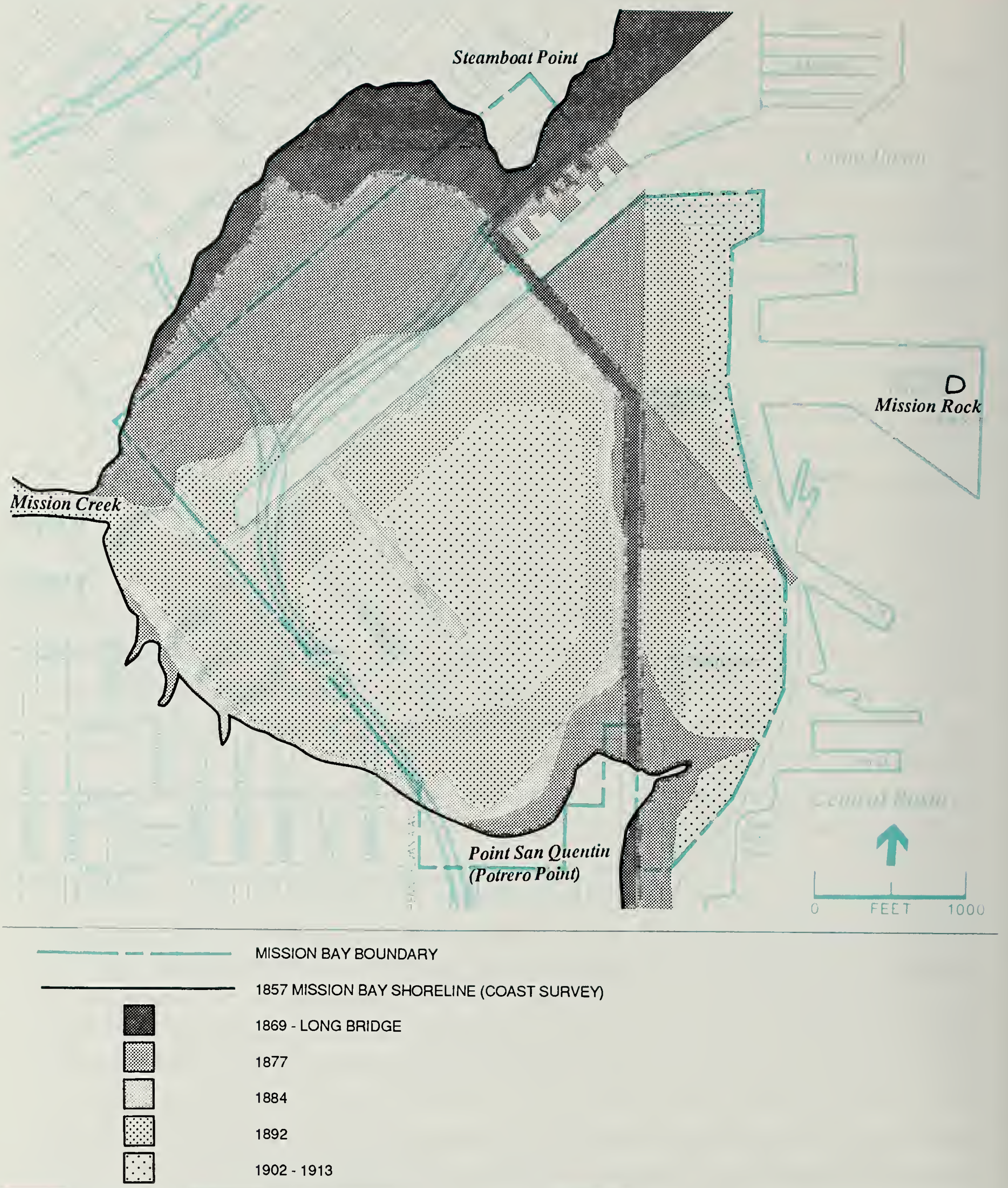
SITE HISTORY

Filling of Mission Bay

Progression of Fill and Fill Materials

The Project Area, originally marshlands and shallow tidal flats bordering San Francisco Bay, was filled during the last 130 years. Figure VI.N.1 illustrates the progression of fill in and around the Project Area. The filling of Mission Bay began between 1859 and 1869, when areas north and west of Steamboat Point (near present-day King Street, between Third and Fourth Streets) were leveled to obtain material with which to fill the northern edge of Mission Bay and the shoreline east of Steamboat Point. One of the first sources of fill was a 100-foot sand hill on Townsend Street./1/ In 1869, the construction of Long Bridge connected Steamboat Point on the northern edge of Mission Bay with San Quentin Point on the southern edge of Mission Bay, roughly along the alignment of present-day Third Street.

Between 1869 and 1877, the fill on the northern edge of Mission Bay was expanded, roughly along Townsend Street between Fourth and Sixth Streets, and wharves were constructed southward from Steamboat Point to what is currently the northern edge of China Basin Channel. Berry Street, between Third and Sixth Streets, existed as filled land in 1877./1/ During that period, large, triangular fills were placed east of Long Bridge, one forming the south side of China Basin Channel and one south of the present-day Fourth Street, east of its intersection with Third Street - perhaps for use as wharves. Long Bridge was widened, and areas north and east of San Quentin Point were filled. Fill materials during that period were, in part, dirt and rock from the Second Street cut in 1869 and serpentine rock blasted from Irish Hill./1/


Steamboat Point
China Basin
Mission Rock
Mission Creek
Point San Quentin
(Potrero Point)
Central Basin
0 FEET 1000
MISSION BAY BOUNDARY
1857 MISSION BAY SHORELINE (COAST SURVEY)
1869 - LONG BRIDGE
1877
1884
1892
1902 - 1913

SOURCE: Environmental Science Associates, Inc.

FIGURE VI.N.1
PROGRESSION OF FILL

By 1884, the margins of Mission Bay had experienced additional fill, decreasing its size, and a long, "T"-shaped, filled pier extended west and south into its center from Long Bridge, forming a portion of what is now the southern side of China Basin Channel. Additional fill was also placed on the northern side of the channel. Between 1884 and 1892, additional filling around the margins of Mission Bay finally enclosed it, shutting off the direct tidal flushing of the Bay. Additional fill was placed to the east of Long Bridge, roughly between the current alignments of Third and Illinois Streets.

From about 1878 to about 1895, the area south of Berry Street between Sixth and Seventh Streets was used as a city dump (see VI.J. Cultural Resources, p. VI.J.9). At its greatest extent, the dump covered as much as 20 acres south of China Basin Channel and accepted as many as 300 wagon-loads per day of trash and garbage. The garbage was shoveled into the waters of Mission Bay, slowly filling it in and seriously polluting the water. A community of human scavengers "squatted" in the dump, which subsequently became known as "Dumpville." They survived by collecting usable materials from the trash and garbage for personal use or resale./1/

The filling of Mission Bay was completed following the earthquake of 1906, when rail lines were used to transport building rubble and debris from the downtown to Mission Bay. In addition to filling in the central portion of the original Mission Bay, this material was used to fill areas to the east of China Basin Street, outside the Project Area, to approximately the current shoreline.

Soil Borings

Present knowledge of the composition of fill materials is based in part on knowing the approximate periods and major sources of the fill (e.g., sand hills, earthquake rubble) and, in part, on borings made for various purposes over about the past 25 years. According to a recent study by Dames & Moore, there are 300 previous borings on record for the Project Area, of which Dames & Moore considered 264 to be usable for describing subsurface conditions./2/ Those borings were made by Southern Pacific Transportation Company, the City Engineer, the Port of San Francisco, California Department of Transportation, Dames and Moore, and Geotechnical Consultants, Inc. Twenty-three borings were made in this area for the Clean Water Program's Bayside Facilities Plan in 1981. Added to these borings are seven test wells and four deep exploratory borings made by Dames & Moore for the Mission Bay project.

The available boring logs for the Project Area were recorded for purposes other than hazardous waste identification, so they are of limited value for the purpose of identifying hazardous waste deposits. These borings indicate that the Project Area was reclaimed with a variety of low-quality, heterogeneous artificial fill material. Most of the recent borings were made along the approximate alignment of Interstate-280 and around the Channel Street Pump Station. Borings in the Project Area encountered brick, wood, organic material, concrete, slag, glass, clay, shells, oil-contaminated sands and silts, asphalt, porcelain, metals, cinder, and cement./3/ In several locations the fill materials exist to a depth of 15 to 20 feet. Fill materials are typically present in two or three distinct strata, indicating either different types of fill, fill from different periods, or both. Two of the borings on Owens Street between I-280 and 16th Street, made for the Clean Water Program, show oil at a depth of three to five feet. Borings north and south of the Southern Pacific Railroad tracks, southwest of I-280, show evidence of oil at a depth of five to ten feet. The groundwater table is typically within the artificial fill.

Underground Facilities

The shallow subsurface zone of the Project Area (i.e., above the groundwater table) contains, or contained, approximately 49 underground storage tanks (USTs)./4/ In addition, there are approximately 51 underground tanks in the blocks of industrial development adjacent to the Project Area. As of June 1988, approximately 13 of the underground storage tanks formerly in use in the Project Area have been abandoned in place or removed. Of the approximately 49 existing and former tanks within the Project Area, 14 hold or held gasoline and 18 hold or held diesel fuel or oil. The contents of the other 17 tanks are unknown; they may have contained gasoline, diesel fuel, or one of a number of liquid industrial chemicals. The average size of underground storage tanks in and adjacent to the Project Area is about 5,000 gallons; the average age of these tanks, based on date of permit (tanks were in the area prior to the start of the permit program), is at least 15 years.

The project sponsor, other landowners, and tenants of the Project Area are engaged in active programs to remove underground storage tanks that are no longer in service. Operators of underground storage tanks in service are required to maintain permits. The City's program for permitting and tracking underground storage tanks, under the jurisdiction of the Department of Public Health, has not yet been implemented fully, so available information is fragmentary. All of the 49 tanks identified in the Project Area are permitted by the City.

Although the exact numbers and locations of tanks still in place in the Project Area are not entirely clear, the information available is sufficient to characterize the subsurface of the Project Area. Use of USTs in the Project Area has been pervasive over an extended period. Because of the number of tanks existing or formerly present in the Project Area, and the general tendency for metal tanks without corrosion protection to leak, it is likely that some leakage has occurred. Project Area soils are above average in salt content, the water table is shallow and brackish, and most tanks apparently were not cathodically protected against corrosion, so the potential for corrosion of steel tanks - and thus the percentage of leaking tanks - may be higher than average. Because of the predominance of gasoline and oil tanks, it is likely that most potential leakage is of petroleum products.

Historic Industries

Historic industrial uses of the Project Area are described in VI.J. Cultural Resources, beginning on p. VI.J.4. Industrial development in the Project Area generally followed the pattern of land filling. The earliest industries were near Townsend and Fourth Streets, and near Mariposa and Third Streets. As the Project Area was filled, industrial development spread around the margins of Mission Bay - southwesterly along the Folsom Street alignment and southeasterly along the Seventh Street alignment - and along Long Bridge (Third Street alignment). The last area to be converted to industrial use was the center of the Project Area, the area bounded by China Basin Channel on the northwest, Fourth Street on the northeast, Sixth Street on the southwest, 16th Street on the south, and Third Street on the east.

The potential for contamination by, and residual hazards from, historic industries in the Project Area varies by the type of industry and the period in which it operated. The Project Area and its vicinity were occupied by a large variety of industries over an extended period. Those industries included petroleum blending and storage, paint products, glass manufacturing, chemical manufacturing, shipyards, steel mills, asbestos storage, railyards, lumber yards, brick and hay storage, tanneries, warehouses, planing mills, wood products manufacturing, brick manufacturing, and gas plants, to name those of most interest. Some of these industries were limited in extent or in time to such a degree that no detailed analysis of their potential to produce hazardous wastes contamination or deposits is possible. Others clearly were benign from a hazardous waste perspective. The industries presented below were major industries in the Project Area and its vicinity, and were investigated for the potential to generate hazardous wastes (see Appendix L. Table XIV.L.2, p. XIV.L.10).

Petroleum Processing and Storage. Petroleum products were stored, and possibly blended, at eight different locations in the Project Area and at two locations near the Project Area. At nine of those ten locations, product storage was apparently the only activity. Hazards associated with those operations, such as product spillage or leaky tanks, may have left residues of tetraethyl lead from leaded gasoline, or polyaromatic hydrocarbons from petroleum oil. Product spillage may have left underground accumulations that still persist. Two of these operations, W.W. Montague & Co., outside the Project Area on Mariposa Street between Illinois Street and Third Street, and Union Oil, in the Project Area on the south side of 16th Street east of Illinois Street, have been active in the past 20 years. Product blending was apparently done only at Mohawk Petroleum, which was in operation for five years during the mid-1940s on the south side of Berry Street between Seventh and De Haro Streets, outside the Project Area.

Paint Products. Six companies dealing in paint products were known to be in or near the Project Area. Two of those, Pacific Oil and Lead Works, outside the Project Area on the south side of Townsend Street between Second and Third Streets from about 1867 to about 1913, and American Oil Company, in the Project Area on the south side of Berry Street between Sixth and Seventh Streets from about 1887 until about 1895, ceased operations more than 70 years ago. From 1903 to 1930, Southern Pacific operated a paint shop on the east side of Third Street near Fourth Street. Another, the Pacific Bridge Paint Company, was in the Project Area in the 1950s on the parcel bounded by Owens, Sixth and 16th Streets. Two others, C.L. Duncan Company, outside the Project Area on the south side of 17th Street between Mississippi Street and Pennsylvania Avenue from about 1948 to about 1956, and Pacific Coast Paper Mill, outside the Project Area on the south side of 17th Street between Texas and Mississippi Streets from about 1951 until about 1966, ceased operations prior to 1967. Several paint pigments contain lead, and some contain chromium or cobalt, so these materials likely were present in or near the Project Area. Pigments containing heavy metals such as lead can cause chronic illness or nervous system damage when regularly ingested for long periods.

A second potential source of residual hazards from paint manufacturing is dumping of the solvents used for cleaning paint-manufacturing equipment. The solvents themselves are volatile, and spills of these materials would not have persisted in surface soils for any length of time. Large spills or on-site disposal of used solvents could possibly contaminate groundwater. The pigments present in spilled, used solvents would have remained, presenting a hazard potential similar to that discussed for paint pigments, above.

Glass Manufacturing. Glass may have been produced at the following sites in and near the Project Area:

- Pacific Coast Glass Works, outside the Project Area on the western side of Seventh Street between Hooper and Daggett Streets from 1902 to 1930;
- San Francisco Glass Works, in the Project Area on the southern side of Townsend Street between Third and Fourth Streets from about 1867 to about 1871, on Fourth Street from about 1871 to about 1875 (as Newman & Derval), and on the southern side of King Street between Third and Fourth Streets from about 1875 to about 1900; and
- Pacific Glass Works, near the southern boundary of the Project Area from about 1893 to about 1877. The precise location of this plant is not known: it was located either near the intersection of Iowa (present-day Third Street) and Mariposa Streets or on Minnesota Street, just north of its intersection with Mariposa Street.

Three of those sites were in operation for a short period more than 100 years ago; two were in operation for over 25 years. Only one was in operation as late as 1930. Residues from glass manufacturing would consist of the raw materials or the finished products. The raw materials were primarily oxides of calcium, aluminum, magnesium, sodium, lead (for leaded glass only; the available record does not indicate whether leaded glass was manufactured in the Project Area), and potassium; minor raw materials (coloring agents) were oxides of arsenic, iron, copper, selenium, chromium, cadmium, and cobalt./5/ The finished products were primarily non-toxic, non-leachable silicates and borates. Once they were incorporated into glass, the concentrations of coloring agents would be greatly diluted and the rate of leaching of these materials and other adulterants out of the glass would be extremely low, because glass weathers very slowly and is largely impermeable to water. In fact, glass is one material currently being evaluated by state and federal agencies for use in encapsulating hazardous and radioactive wastes./6/

Chemical Manufacturing. No chemical manufacturing operations existed within the Project Area. Three chemical companies, however, operated within one block of the Project Area in the past:

- Golden City Chemical Works, on the northern side of Townsend Street between Sixth and Seventh Streets from about 1867 to about 1894, produced sulfuric and nitric acids. None of the raw materials - sulfuric acid, sodium nitrate, potassium nitrate - leaves insoluble residues, and soluble residues would have degraded long ago into stable and harmless nitrogen, potassium, sulfur, and sodium compounds, and been diluted into large volumes of soil. Sulfuric acid production by the lead chamber process may have generated scrap lead but, because of the prevalence of metal scavenging and the value of lead, it is unlikely that substantial amounts of lead were left on the site.

- Hochwald Chemical Company, on the southern side of 17th Street between Mississippi Street and Pennsylvania Avenue from 1940 to 1959, produced insecticides that probably included arsenic, copper, mercury, and lead compounds. Soil contamination could have resulted from spills of those materials. Some of those materials are moderately soluble in water and, if spilled on the site, would have dispersed somewhat during the past 30 years.

- Yosemite Chemical Company, on the southern side of 17th Street between Mississippi Street and Pennsylvania Avenue from about 1948 to about 1962, produced rust preventatives and rust removers. The active ingredients in these materials are organic acids, oils, paints, and anti-oxidants.

Shipyards. Shipbuilding, repairing, and related industries were represented in and near the Project Area by four companies:

- Boole and Beaton's Shipbuilding Yard, in the Project Area on the southern side of Berry Street between Fifth and Seventh Streets from about 1883 to about 1885;

- Alexander Hay's Shipbuilding Yard, in the Project Area on the south side of Berry Street between Fifth and Seventh Streets from about 1889 to about 1913;

- Bethlehem Shipbuilding Corporation, just outside the Project Area between Mariposa and 18th Streets, west of Illinois Street to Third Street, from about 1920 to about 1967; and

- Kneass Company Boat Building, outside the Project Area east of Illinois Street between 17th and 18th Streets, from about 1920 to about 1970.

Modern shipbuilding involves processing steel plate, including shearing, cutting, rolling, and welding. Residues of these activities would include cutting oil and oil/water emulsions (for lubricating and cooling the metal), and metal scraps and particulate. In addition, there might be asbestos (from insulation used for steam kettles and fire boxes), paint pigments (such as lead-oxide paints used on the underside of ships as an anti-foulant), and solvents.

Before about 1920, the boatbuilding industry may have used tar to seal wooden hulls. After about 1920, boatbuilding would have used fiberglass and various other resins, which required solvents for cleanup. The solvents, being volatile, would not persist on the site.

Resins spilled on the site may have hardened and cured to an inert, harmless material or may still be in a liquid state, depending upon their formulation and containment.

Steel Mills. Pacific Rolling Mill operated two steel mills just outside the Project Area from 1906 to 1928, one on the north side of 17th Street between Mississippi and Texas Streets and the other on the south side of 17th Street, that could have left steel-working residues similar to those described for shipyards.

Asbestos. Asbestos processing and storage took place at two locations within the Project Area and on one site just outside the Project Area. One company within the Project Area is known to have processed asbestos-containing raw materials. Plant Asbestos Company, south of 16th Street and east of Illinois Street, operating from about 1948 to about 1970, apparently was a warehouse. I.L. Merrell, on the north side of Townsend Street between Fourth and Fifth Streets, operating outside the Project Area from about 1881 to about 1889, apparently produced asbestos products. Commercial Mineral Company, between Sixth and Seventh Streets south of China Basin Channel between 1930 and 1961, processed an asbestos-containing mineral, tremolite, in its rock-grinding operations.

Rail Facilities. Major portions of the Project Area originally were filled to provide land for rail facilities. Rail facilities, consequently, have constituted a major use of the Project Area from the late 1800s to the present. Southern Pacific had a large roundhouse and engine house from about 1909 to about 1960 north of Mariposa Street between Third Street and the present alignment of I-280. Major Southern Pacific maintenance facilities were in the block bounded by Fifth, Sixth, Townsend, and Berry Streets from about 1935 until 1985. In the northeastern portion of the Project Area, east of Third Street and north of the Fourth Street right-of-way (now abandoned), the Atchison Topeka and Santa Fe Railway built an engine house and maintenance facilities in about 1916; the facility apparently operated until about 1967.

Rail yards and rail-related uses are considered to be a potentially hazardous land use. Rail yards in other parts of the Bay Area have been found to have extensive, but usually shallow, contamination with petroleum products and metals involved in operating and servicing locomotives and rail cars. Weed-abatement practices in rail yards may have included frequent spraying of ground surfaces with light oils or synthetic chemical herbicides. Rail cars, like the crates in warehouses, can hold a wide variety of materials, but rail cars hold much larger quantities. Thus, spills and leaks from rail cars could have led to shallow contamination of rail yard soils.

Hazards from Existing Industries

Permitted TSD Facilities

Three industries in and seven near (within 2,000 feet of) the Project Area are registered under the Resource Conservation and Recovery Act (RCRA) as hazardous waste Generator, Transfer, or Treatment, Storage, or Disposal (TSD) facilities (see Table VI.N.1). Such industries are regulated at the federal level by the Environmental Protection Agency (EPA), at the state level by the Department of Health Services (DOHS), and at the local level by the City and County of San Francisco Public Health and Fire Departments. Nine of the ten facilities are hazardous-waste generators, with eight of the nine each generating more than 1,000 kg (2,200 lbs) of wastes per month. Four of the facilities are transporters of hazardous wastes, and two of the facilities are permitted as disposal facilities.

Potentially Hazardous Industries

In addition to permitted hazardous waste TSD facilities, the Project Area contains numerous industrial firms that may handle small to moderate quantities of hazardous materials. The Association of Bay Area Governments has identified, by Standard Industrial Classification (SIC), 40 key industrial types that use such materials (see Appendix L. Table XIV.L.3, p. XIV.L.21). Seventeen businesses in and seven near the Project Area fall within six of the 40 SIC categories: Paint and Varnish Manufacturing; Electroplating; Ship Building/Repair; Warehousing/Storage; Petroleum Gas Production/Distribution; and Sewage Systems.

The most common "hazardous" industries in the Project Area are warehouses and ship-building/repair. The amounts and types of hazardous materials associated with warehousing are difficult to assess; individual warehousing activities may or may not involve hazardous materials, and the types of materials are likely to change over time. Ship-building and repair activities can involve a wide variety of acids, solvents, flammable liquids, and other hazardous materials.

TABLE VI.N.1: PERMITTED HAZARDOUS WASTE FACILITIES IN OR NEAR THE PROJECT AREA/a/

Facilities Within the Project Area	Assessor's Parcel Number	Facility Type
H&H Ship Service Co. 220 China Basin Street	3880-1	Generator (3) Transfer
Pacific Motor Trucking Company 1355 Sixth Street	3810-7	Generator (1)
Salinas Valley - Santa Cruz Motor Express 1760 Third Street	3810-7	Transfer
Facilities Outside the Project Area		
C&M Plating Works 498 Sixth Street	3779-13	Generator (1) Disposal
Coach Specialties, Inc. 601 Mariposa Street	3996-11	Generator (1)
Continental Maritime of SF Piers 50 and 54	Pier 54 Pier 50	Generator (1) Transfer
Glidden Company 1000 16th Street	3833-1.2.3 3950-4	Generator (1) Disposal
Greyhound Lines, Inc. 480 Irwin Street 3820-1	3807-2.4 3808-1	Generator (1)
Sun Chemical Corp. 651 Brannan Street	3785-9	Generator (1) Transfer
Pacific Bell 329 Brannan Street	3788-27	Generator (1) Transfer

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Class (1)	Generators of more than 1,000 kg per month of waste.
Class (2)	Generators of more than 100 - 1,000 kg per month of waste. Class (2) is not used in this Table.
Class (3)	Generators of less than 100 kg per month of waste.

/a/ Facilities holding DOHS / EPA RCRA permits, as listed by those agencies.

SOURCE: Environmental Science Associates, Inc.

Several businesses in the Project Area, while not indicated as "key" hazardous industries by ABAG according to their SIC classifications, are likely to store and use small quantities of hazardous materials. These firms include vehicle maintenance and repair facilities, vehicle body shops, vehicle storage, printing and lithograph shops, oxygen and flammable gas sales, scrap metal sales, paint shops, and trucking/transfer stations.

Surface Conditions/7/

Surface conditions are one indicator of potential hazardous waste contamination. Areas covered by buildings reveal nothing, but paved areas provide an indirect indication of the approximate location of underground facilities, such as underground storage tanks, deduced from fill tube, vent, and pump locations, or patched pavement following recent excavation. Unpaved open areas reveal subsurface conditions through stockpiled materials on the surface, absence of healthy vegetation, soil disturbance, and surface soil staining.

The most prevalent surface indication of potential subsurface contamination is soil staining by petroleum products. Staining along rail lines is common in the Project Area, but those stains are expected to reveal shallow contamination, probably entirely within one foot of the surface and limited, laterally, to the railbed. Occasional stains found in other locations in the Project Area may have resulted from small, individual incidents - such as crankcase oil from an automobile oil change. However, those stains may be the product of repeated dumping or of surreptitious dumping of a large amount in one incident (midnight dumping). The most serious indication of potential, widespread petroleum contamination of the soil in the Project Area is at Sixth Street Auto, an abandoned garage on Sixth Street (Assessor's Block #3835, Parcel 3). The unpaved soil surrounding the building on that lot has been soaked thoroughly with oil; there are also more than 30 old barrels of paint on the northwestern corner of that lot.

Another prevalent indicator of potential contamination is the lack of weeds or other vegetation, such as in the rail yards in the Project Area. While soils in the rail yards have not been tested, those areas are virtually weed-free, and even totally lacking in dead vegetation that might indicate growth of vegetation in recent years. On the basis of hazardous waste investigations of other rail yards and maintenance facilities in the Bay Area, and knowledge of the weed-abatement practices common in the past, it appears likely that rail yards in the Project Area were treated regularly with light oils, salt, or other chemicals for weed abatement.

Piles of trash, barrels, and other waste materials, such as broken asphalt paving and lumber, are found commonly on vacant lots in the Project Area. They indicate a general level of neglect, and some of the materials may cause very local soil contamination, but those conditions do not generally or necessarily indicate substantial subsurface hazardous waste deposits or contamination.

IMPACT

A number of industries historically present in the Mission Bay Project Area could have used, generated, or otherwise been involved with hazardous materials, as discussed beginning on on p. VI.N.9. Those include major industries involved with petroleum processing storage, paint products, glass manufacturing, shipbuilding, and railroad facilities. In addition, a variety of minor industries that may have used, produced, or stored smaller quantities of hazardous materials were active in the Project Area.

Soils in the Project Area have not yet been sampled or analyzed. The historical record, however, suggests that toxic residues in soil probably occur in many places in the Project Area. Rail yards, which may have been treated extensively with herbicides or pesticides, and other properties that have been occupied by industrial uses are especially sensitive./8,9/ Wooden remnants of buildings, fences, platforms, and sheds anywhere in the Project Area are likely to be contaminated with chemical preservatives./10/ Spills of oil and petroleum products are ubiquitous throughout the Project Area, especially in the old rail yards operated by Southern Pacific and Santa Fe railroads. Metal compound residues from many industries could persist. Remnants of hazardous materials spills or hazardous chemicals in sealed containers or tanks may occur at numerous locations in Mission Bay. The Project Area fill itself could contain a variety of hazardous substances, especially in the area formerly used as the city dump. Finally, isolated instances of "midnight dumping," where wastes from outside an area are secretly and illegally dumped at a site, could have occurred in the Project Area.

Throughout the build-out period in all three Alternatives, hazardous contaminants could be encountered during excavation, dredging, and site preparation, should the parcels to be developed not be properly surveyed for hazardous materials and cleaned up before construction commences. Undetected contaminants could also pose health risks for future occupants of the Project Area.

The Project Area is so large, and the range of historic activities and potential hazardous compounds so diverse, that many differences among Alternatives generally are not meaningful as applied to potential hazardous waste impacts. Many parcels in the Project Area have had multiple industrial uses and have the potential to be contaminated with nearly every hazardous substance listed in Table VI.N.2. For compliance with San Francisco's Hazardous Soils Ordinance (see p. VI.N.2), the soil throughout the

TABLE VI.N.2: HAZARDOUS MATERIALS LIKELY TO BE ENCOUNTERED IN THE PROJECT AREA/a/ •

Material	Hazardous Properties					
	Toxic	Corrosive	Ignitable	Reactive	Carcinogenic/b/	Bioaccummulative/c/
Acetone			X			
Arsenic sulfide(s)	X				X	X
Asbestos	X				X	
Benzene	X		X		X	
Cadmium oxide	X	X		X	X	
Calcium oxide		X		X		
Chromium trioxide	X	X		X		
Copper acetate	X					X
Copper acetoarsenite	X				X	X
Creosote and coal tar	X				X	
2,4-D	X					X
DDD / DDT	X				X	X
Diesel fuel / Gasoline			X			
Lead	X					X
Magnesium			X	X		
Mercury compounds	X					X
Nitric acid	X	X				
Pentachlorophenol	X					
PCBs	X				X	X
Selenium dioxide	X					X
Sulfuric acid	X	X				
Tetraethyl / Tetramethyl lead	X		X			
Toluene / Xylene	X		X			
2,4,5-T	X				X	

/a/ Information derived from CAC, Title 22, Division 4, Chapter 20, Article 9, 1985; Sitting, 1985; Weiss, 1980; and U.S. Coast Guard, 1984.

/b/ Capable of causing cancer in animals or humans.

/c/ Capable of being taken up by plants or animals, stored or concentrated in living tissue, and passed up the food chain to other animals or humans.

SOURCE: Environmental Science Associates, Inc.

Project Area would have to be tested prior to obtaining building permits for development of each parcel under all Alternatives, since the land use history of the Project Area indicates a high potential for hazardous material contaminants. However, some differences do exist in proposed schedules and patterns of build-out and future land use among the three Alternatives.

This subsection discusses impacts that hazardous materials potentially found within the Project Area might have on the various Alternatives and stages of project development. The hazardous waste potential, public health risk, and impacts of the hazardous materials most likely to be present in the Project Area are discussed on the basis of known past and current industrial activity.

The subsection describes briefly the potential sources, types, and environmental fates of hazardous materials, and goes on to discuss potential clean-up options and activities. It addresses the potential risk to public health; the sensitive receptors, such as workers, residents, and wildlife; and the potential types and pathways of exposure. For 2000 and Build-Out/2020, this subsection generally describes the relationship between development of the Project Area and ongoing site investigation and clean-up for each Alternative. Throughout, the section emphasizes the types of health impacts that could be expected. The possibilities for treatment, removal, and other clean-up options and their potential impacts are discussed generally.

- A separate document, the Mission Bay Hazards Mitigation Program (the Mitigation Program), has been prepared and is incorporated by reference into this EIR./8/ Information in that document is summarized in the remainder of this paragraph. The Mitigation Program contains a parcel-by-parcel summary of information available on historic and existing industrial uses in the Project Area, a summary of known subsurface investigations, a general description of site investigation and remediation methods and approaches, specific recommendations on additional site investigation, and an overall framework for phasing remediation procedures, if necessary for the Project Area. While the Mitigation Program presents general recommendations for site investigation and clean-up, the actual investigative and (if necessary) remedial methods would comply with applicable laws at the time of implementation, and would be conducted under the direction and with the approval of all local, state and federal agencies having jurisdiction. The existing legislative authorities of various local, state and federal agencies in the area of hazardous wastes are described beginning on p. VI.N.1. The Mitigation Program would not apply to Alternative N, the No-Project Alternative, for which there would be no overall development plan. Site investigation and clean-up for Alternative N would be carried out on a parcel by parcel basis as a result of individual development proposals as development proceeded.

HAZARDOUS WASTE POTENTIAL

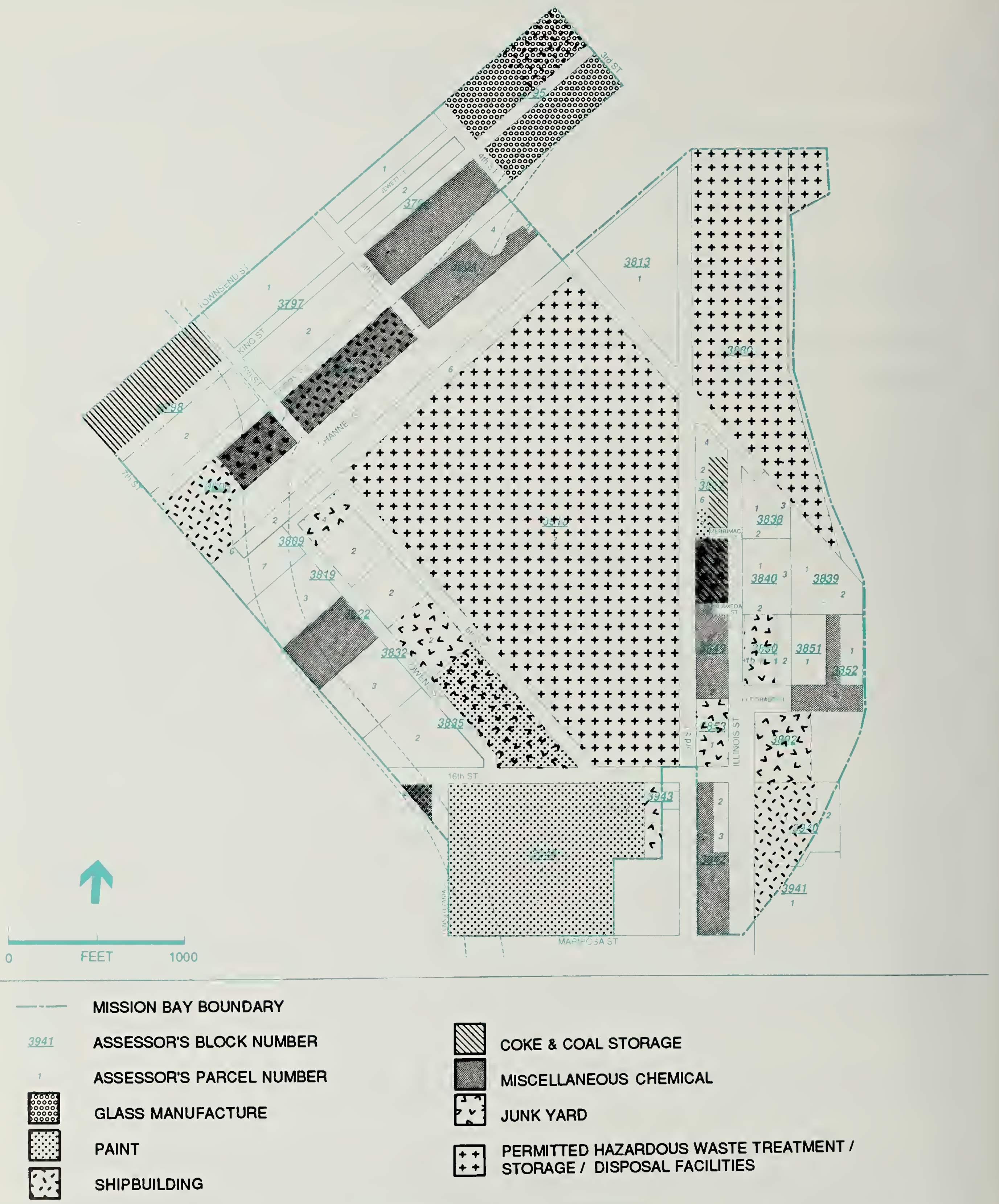
Potential Sources of Hazardous Materials in the Project Area

Hazardous materials in the Project Area would be primarily residues of various industrial, commercial, and landfilling activities. Many hazardous materials could have been spilled on the site during normal use. Others may have been disposed of or stored on the site. Still others could have been spread deliberately to control weeds or pests -- as is evidenced by the condition of many of the rail yards -- or applied to structures as wood preservatives. Until the Project Area parcels are sampled, the presence of dispersed toxic materials at concentrations that exceed state of federal standards cannot be confirmed. Maps showing Mission Bay parcels that had various historic heavy industrial uses of types that would have been likely to expose the Project Area to hazardous materials are presented in Figures VI.N.2, VI.N.3, and VI.N.4. Because of gaps in the historical record and the possibility of dumping, the lack of a known historic industrial or rail use on a parcel should not be taken as implying that the parcel is uncontaminated.

A hazard could exist from ruptured, leaking, or damaged containers and underground storage tanks that may still be stored or buried in the Project Area. (Excavation, dredging, grading, and surcharging plans that might unearth, spread, or otherwise disturb toxic materials were described in VI.K., Geology and Seismicity, beginning on p. VI.K.19.) Finally, several industrial facilities still exist on the site; two of them generate hazardous waste in their industrial activities and processes, and have been issued the appropriate state and federal permits required for hazardous-waste generators.

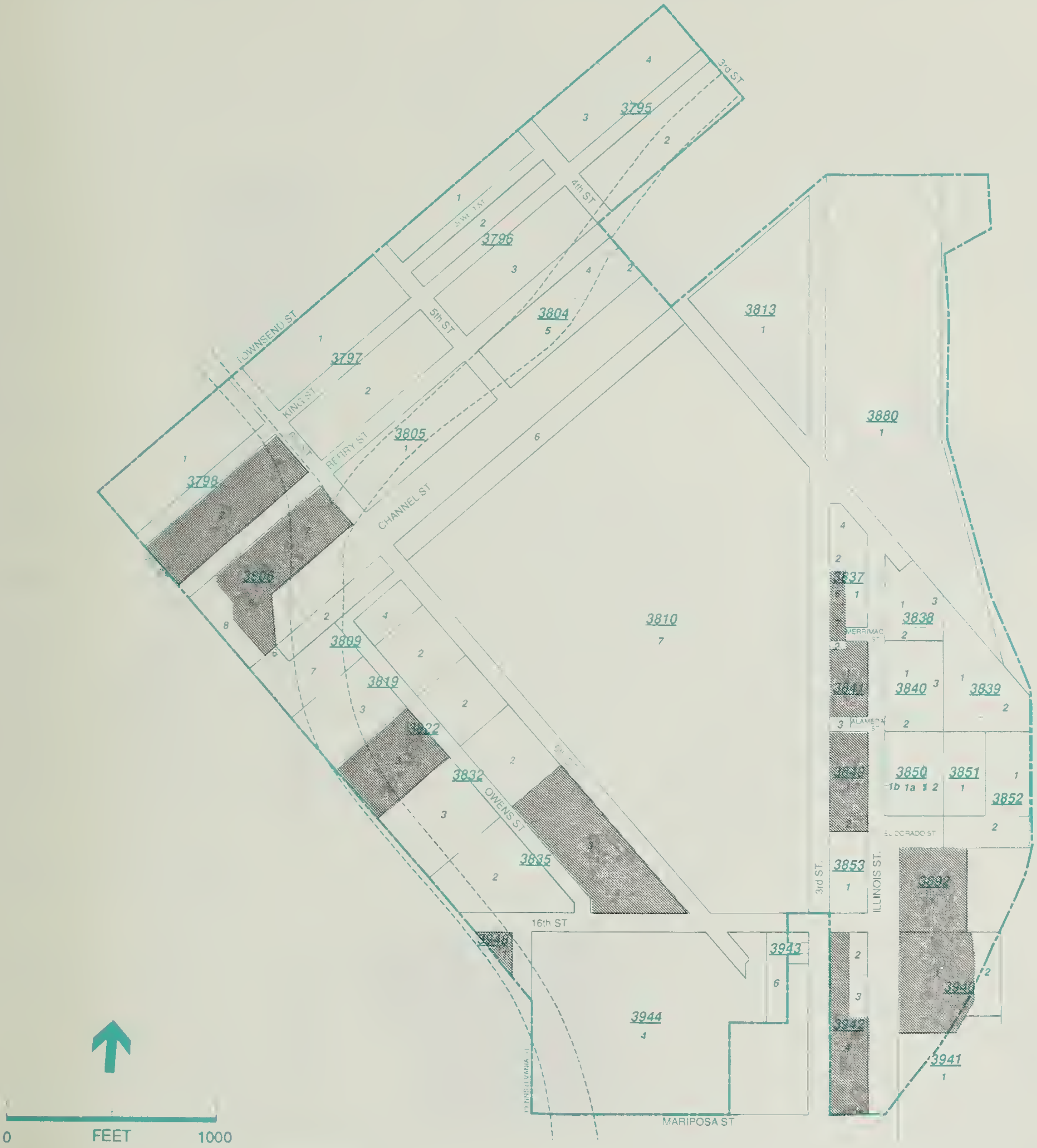
Potential Types of Hazardous Materials in the Project Area/11,12/

Hazardous substances fall into one or more of four categories, depending on their physical and chemical properties: reactive, ignitable, corrosive, and toxic./13/ These categories are not mutually exclusive; for example, a substance can be both toxic and ignitable. The Project Area may contain hazardous substances in any of these categories, although materials in the toxic group are the most likely to be present because of their generally greater environmental persistence. Table VI.N.2, p. VI.N.19, presents a list of materials


3rd ST
4th ST
5th ST
7th ST
TOWNSEND ST
KING ST
JEWETT ST
CHANNEL
OWENS ST
16th ST
MARIPOSA ST
ILLINOIS ST
3rd St
3797
3798
3809
3813
3819
3822
3832
3835
3838
3839
3840
3851
3852
3941
3943
0
FEET
1000
MISSION BAY BOUNDARY
3941 ASSESSOR'S BLOCK NUMBER
1 ASSESSOR'S PARCEL NUMBER
GLASS MANUFACTURE
PAINT
SHIPBUILDING
COKE & COAL STORAGE
MISCELLANEOUS CHEMICAL
JUNK YARD
PERMITTED HAZARDOUS WASTE TREATMENT / STORAGE / DISPOSAL FACILITIES

SOURCE: Environmental Science Associates, Inc.

FIGURE VI.N.2
MISCELLANEOUS HISTORIC HAZARDS - SENSITIVE INDUSTRIAL USES IN THE MISSION BAY PROJECT AREA BY PARCEL


3rd ST
3795
4th ST
3796
TOWNSEND ST
5th ST
3804
3813
3797
KING ST
BERRY ST
3805
3880
3798
CHANNEL ST
3806
3837
3809
3810
3838
3819
3840
3839
3822
ALAMEDA ST
3832
3850
3851
OWENS ST
3852
EL DORADO ST
3835
3853
3rd ST.
ILLINOIS ST.
3882
16th ST
3943
3940
3944
3942
3941
MARIPOSA ST
0
FEET
1000

— · — MISSION BAY BOUNDARY

3941 ASSESSOR'S BLOCK NUMBER

1 ASSESSOR'S PARCEL NUMBER

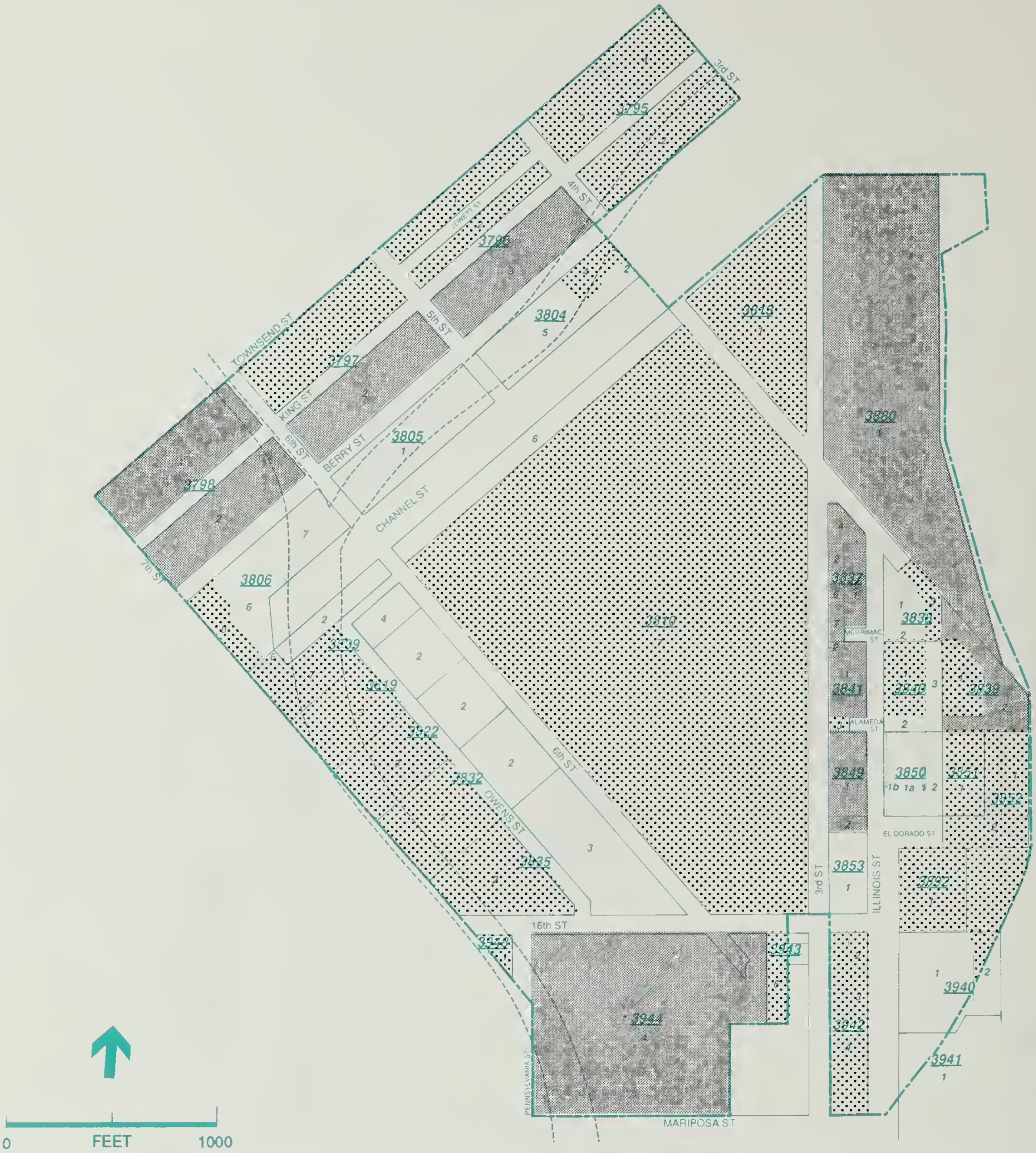
▨ OIL STORAGE AND PROCESSING FACILITIES

NOTE: Figure does not show rail-related oil product storage or existing uses.

Mission Bay

FIGURE VI.N.3
HISTORIC OIL INDUSTRY USES IN THE MISSION BAY PROJECT AREA BY PARCEL

SOURCE: Environmental Science Associates, Inc.


3rd ST
4th ST
5th ST
6th ST
7th ST
TOWNSEND ST
KING ST
BERRY ST
JEWETT ST
CHANNEL ST
OWENS ST
16th ST
MARIPOSA ST
PENNSYLVANIA ST
ILLINOIS ST
MERRIMAC ST
ALAMEDA ST
EL DORADO ST
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3809
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3944
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FEET
1000

—·— MISSION BAY BOUNDARY

3941 ASSESSOR'S BLOCK NUMBER

1 ASSESSOR'S PARCEL NUMBER

░ RAIL TRACKAGE

▓ RAIL-RELATED REPAIR, MAINTENANCE AND SERVICE FACILITIES

NOTE: Rail uses in streets not shown

Mission Bay

FIGURE VI.N.4
HISTORIC RAIL-RELATED USES IN THE MISSION BAY PROJECT AREA BY PARCEL

SOURCE: Environmental Science Associates, Inc.

identified as being most likely candidates to be found in the Project Area. Key hazardous properties (reactive, ignitable, corrosive, toxic) are listed, as well as two additional related properties of concern: the documented ability to cause cancer in living organisms (carcinogenic) and the documented ability to accumulate in the food chain (bioaccumulative). (See the Environmental Fate/Risk Assessment subsection of Appendix L. p. XIV.L.29 and Table XIV.L.4, p. XIV.L.22, for additional information on sources and properties of hazardous chemicals.)

Reactive Materials

Reactive materials have properties of explosivity or violent chemical activity. Chemicals classified in this group that could possibly be found in the Project Area include calcium oxide and magnesium metal. Neither of these materials, however, could be present as dispersed pollutants in soil or water. Both react with water (especially if the water is acidic) and could persist on the site only if kept in tightly sealed containers. If not properly handled, they could pose a hazard to construction workers during site preparation activities. Aside from the reactive nature of these materials, their toxic properties are not severe and would be limited to temporary irritation of eyes, nose, and throat.

Ignitable Materials

Ignitable materials are those capable of being set on fire, of bursting into flame spontaneously, or being ignited through interaction with another substance. These include acetone, benzene, gasoline, diesel fuel, tetraethyl lead, tetramethyl lead, toluene, and xylenes. All are common industrial solvents, fuels, or fuel additives, and most are volatile and mobile. The hazard of these materials lies in the danger of fire or explosion, should they be improperly stored or handled. Benzene, toluene, xylenes, tetraethyl lead, and tetramethyl lead also have toxic properties. Although all except acetone are insoluble in water, large or repeated spills of these liquids could result in contamination of the groundwater. This group of materials could pose hazards to workers or clean-up crews during site construction or preparation. In general, these materials are volatile and tend to disperse in the air. Like the reactive chemical group, these flammable liquids would not persist at or near the surface of the site in appreciable quantities unless they were stored in sealed containers. However, underground leaks of these materials could persist for years and possibly contaminate groundwater.

Corrosive Materials

Corrosive materials have the ability to dissolve organic and inorganic materials. Candidate chemicals in this group include cadmium oxide, calcium oxide, chromium trioxide, nitric acid, and sulfuric acid. All are commonly used in industrial processes. As with the reactive and ignitable groups, the corrosive properties of these chemicals would not persist indefinitely in the environment, but would be spent by contact with metals or organic matter such as wood, paper and plastic, which can be attacked and broken down by corrosive materials. Certain corrosive agents such as the acids can also be countered by minerals such as oxides, sulfides, or other natural materials that would act to gradually neutralize or remove the corrosives from the environment. Corrosive materials would have to be isolated in sealed containers in order to pose a hazard at the site. Calcium oxide is relatively non-toxic, but the other four chemicals cause severe damage upon contact with eyes and skin, and should be considered highly dangerous. These materials could present hazards to construction workers or clean-up crews during site preparation.

Toxic Materials

Toxic materials include both acute toxics and chronic toxics. Acutely toxic materials can cause injury, illness, or death to humans or other organisms as the result of a single exposure of short duration, or a single dose. Chronically toxic material can cause injury, illness, or death through prolonged or repeated exposures or consumption. This is the largest and most hazardous group of substances likely to be found in the Project Area. This group includes the flammable liquids benzene, toluene, xylenes, tetraethyl lead, and tetramethyl lead; the acute corrosives nitric acid and sulfuric acid; the metallic pollutants arsenic sulfide(s), cadmium oxide, chromium trioxide, copper acetate, copper acetoarsenite, mercury compounds, and selenium dioxide, all of which are poisonous; the industrial contaminants asbestos, creosote, and PCBs; and the organic pesticides and herbicides 2,4-D, DDT, DDD, pentachlorophenol, and 2,4,5-T. Some materials in this group, especially the metal compounds, pesticides, asbestos, and PCBs, display an environmental stability and persistence that makes them potential health threats on a long-term basis. Other materials, such as the flammable liquids, are relatively non-persistent. Public-health-related effects of toxics are discussed in the Environmental Fate / Risk Assessment subsection of Appendix L., p. XIV.L.29.

Environmental Fates of Hazardous Materials

Substances that are corrosive, ignitable, or reactive would tend not to persist on the site unless they were held in containers or storage tanks. As a general rule, materials in these three categories are chemically too reactive to persist for long in the environment. However, recent spills or leaks of these substances could occur at the site and persist for short periods. Chronic leaks could cause a long-term problem until found and corrected. Any containers of these materials found at the site would be removed during site clean-up.

The materials in the toxic group are chemically stable, relative to other types of hazardous wastes, and could persist for long periods in soil, structures, or groundwater. Some of these chemicals gradually detoxify through metabolic, chemical, or photochemical oxidation, but others display toxicities that do not decrease with time, or else degrade only slowly./11,14,15/ Many, especially the metal compounds and some pesticides, are very stable and will persist in the environment for years./16,17,18/ Some are relatively mobile in the environment, and soluble enough to contaminate groundwater at the site./19,20/ Some are taken up in the food chain and become concentrated in living organisms./10,15/ Appendix F. of the draft Mitigation Program discusses environmental fates of each hazardous chemical that could be found in the Project Area.

Volatile materials, if released at the ground surface, would evaporate and would not be expected to persist at the site. Non-volatile materials would be found in soils and on structures, building materials, debris, and trash. The primary site repository of hazardous contaminants would be surface soils contaminated by spills or other applications of hazardous materials, and filled parcels. Subsurface layers saturated with groundwater could contain a variety of hazardous materials, both in solution and associated with the substrate (fill or soil). Several pathways exist that allow contaminants to mobilize or move through the environment, and thus come into contact with sensitive receptors. These pathways include direct physical contact; transport in a dissolved or suspended form in water; transport as gas, vapor, aerosol, or dust in air; and transport by plants or animals through the food chain. These pathways are described more fully in Chapter IV. of the draft Mitigation Program.

CLEAN-UP OF HAZARDOUS MATERIALS

All three Alternatives would require excavation of surface soil on many parcels. Large amounts of excavation are planned for Alternatives A and B; in addition, Alternative A would require dredging in China Basin Channel. Much of the surface soil at Mission Bay may be contaminated to levels that would require either treatment or removal from the site; those levels are set by state and federal regulations. Treatment probably would be required for all three Alternatives. Differences in total volumes of soil to be excavated or dredged among the three Alternatives would vary the likelihood of disturbing or excavating contaminated soil or materials. Staged site remediation activities among sites within one phase or among phases of the project could increase potential effects of an individual site or phase. Relatively few people would be on site when clean up begins; consequently, relatively few people would be exposed to most of the effects of site changes. During following phases of construction, portions of the commercial, industrial, and residential uses of the project would be completed and most likely occupied. Consequently, site clean-up would affect an increasingly greater number of people during later phases of development, especially in the residential portions of the Project Area, where clean-up could occur near occupied residential units. (During site investigations for hazardous waste, buffer zones would be established that would undergo investigation and clean-up to minimize such interactions.) An extensive discussion of clean-up methods and treatment options is provided in Chapter VI. of the draft Mitigation Program.

If dredged materials contain high concentrations of hazardous materials, they probably could not be deposited at an approved disposal site in San Francisco Bay; like excavated soils, they probably would have to be treated or trucked from the Project Area to an approved landfill. Dredged material may require dewatering prior to removal to minimize volume and reduce the possibility of leakage during transport. More information on sediments is provided in VI.J. Hydrology and Water Quality, p. VI.J.10.

All of the hazardous waste materials potentially present in the Project Area can be removed or rendered harmless by means of existing technology. Some clean-up options, however, might be considered economically infeasible. The three types of cleanup possible for hazardous materials identified in the Project Area are on-site treatment and disposal, on-site internment, and off-site disposal.

Until recently, off-site disposal was the only treatment option for most wastes. On-site treatment, using methods such as stabilization, encapsulation, aeration, or contaminant extraction, is receiving increasing emphasis, but may not be practical for all wastes found in the Project Area. The ideal treatment would extract, remove, or otherwise decontaminate the hazardous material and render the substrate (usually soil) non-hazardous. Such technologies are developing rapidly, and will merit serious consideration in the future. On-site internment - sealing contaminated soils under a clay layer of low permeability, for example - may not be a permanent solution and perhaps would only postpone treatment or disposal. The potential for recontamination, due to a leak in the containment structure, would continue to exist. With hazardous waste regulations becoming more stringent and comprehensive at all levels of government, removal of wastes contained on the site may be required at a later date. Table VI.N.3 lists preferred treatment processes for the hazardous materials likely to be found in the Project Area. For Alternatives A and B, clean-up alternatives other than disposal are likely to be subjected to a higher level of regulatory scrutiny than for Alternative N, because of the residential and open-space uses proposed in the former.

Clean-up of hazardous materials discovered in the Project Area would be effected for reactive, ignitable, and corrosive materials by locating and removing any tanks or containers holding these substances, sampling the soil and substrate to determine the extent of contaminated materials, and subsequently excavating and trucking off any substrate contaminated by leaks or spills. For toxic substances, the same procedures would be followed, with the major addition of comprehensive soil and substrate sampling and analysis, followed by treatment of the hazardous material (probably by excavation and removal of contaminated soil or other material). Of the four types of hazardous compounds, those in the toxic and ignitable categories would be the principal contaminants expected to have persisted over time as soil contaminants in the Project Area. Reactive or corrosive materials would not persist for long in soil because of their characteristics, but could persist on the site in sealed containers.

Under all Alternatives, portions of the Project Area proposed for development (along with an appropriate buffer zone) would be investigated, and any necessary remedial work completed prior to development. The draft Mitigation Program presents an overall framework for confirmation investigations for master-planned Alternatives A and B. It provides for an Areawide Survey of the entire Project Area, consisting of surface soils and soil gas sampling. The Areawide Survey would be accompanied by detailed, programmed sampling and testing of soil, soil gas, and groundwater in the areas affected by each development phase (referred to as Development Phase Area Investigations) prior to the start of development for each phase. The Mitigation Program provides guidance as to which potential contaminants should be analyzed in surface soils, subsurface soils, groundwater, or soil gas. Specific sampling techniques, analytical methods, quality assurance, and other elements of the confirmation investigations are recommended in the Mitigation Program.

TABLE VI.N.3: PREFERRED TREATMENT PROCESSES FOR HAZARDOUS WASTES

	Treatment/a/						
Material	Physical	Thermal	Chemical	Biological	Immobilization	In-Situ Degradation	Soil Flushing
Acetone	X	X					X
Arsenic sulfide(s)				X			
Asbestos					X		
Benzene	X	X					
Cadmium oxide					X		
Calcium oxide			X				X
Chromium trioxide			X		X		
Copper acetate			X		X		
Copper acetoarsenite			X		X		
Creosote and coal tar		X					
2,4-D		X		X		X	
DDD / DDT		X	X				
Diesel fuel / Gasoline	X	X				X	
Lead, Tetraethyl / Tetramethyl	X	X	X		X	X	
Magnesium					X		
Mercury compounds	X	X			X		
Nitric acid			X				X
Pentachlorophenol		X	X	X		X	
PCBs		X	X		X		
Selenium dioxide					X		
Sulfuric acid		X					X
Toluene / Xylene		X		X		X	
2,4,5-T		X	X	X		X	X

NOTE: Information derived from Sittig, 1985; and Environmental Science Associates, Inc., 1988.

/a/ Physical treatment processes include evaporation, extractions, and mechanical scrubbing of the contaminant.
Thermal treatment is incineration by any method.
Chemical treatment includes neutralizing acids and caustics, oxidation or reduction, and chemical scrubbing of waste streams.
Biological treatment is microbial decomposition at secondary sewage treatment plants.
Immobilization is deposition in a remote hazardous waste repository.
In-situ degradation includes on-site microbial and photo-oxidation processes.
Soil flushing washes the hazardous material out of the substrate (usually soil); it can then be collected, concentrated if desirable, and treated. Following treatment, the material may be discharged into a sewer or to surface waters, if rendered completely non-hazardous, or disposed as are other hazardous wastes.

SOURCE: Environmental Science Associates, Inc.

As presented in the Mitigation Program, site clean-up activities would be isolated, as much as possible, from other site activities. Clean-up crew activities should be scheduled so that their work is sufficiently distant from construction activities on adjacent and nearby parcels. A buffer zone would be kept between clean-up work and initiation of construction activities on adjacent land where clean-up work has been completed. This precaution would minimize the likelihood that adjacent parcels would be disturbed by clean-up equipment or recontaminated by movement of fugitive contaminants. This buffer zone would be defined by the type of hazard and remediation technology, and would be maintained between clean-up activities and areas undergoing construction and occupation throughout all phases of project development.

Hazardous materials disposed of off-site would be transported to a Class I facility, as required by the Department of Health Services (DOHS) and the Environmental Protection Agency (EPA). Approval to truck wastes to a Class I site would have to be obtained in advance. The status of these facilities and the identities of wastes they are authorized to accept are often in a state of flux due to evolving regulatory rulings. Land disposal of many hazardous wastes is being phased out. Additional regulations and substantial changes in existing regulations for disposal can be expected prior to commencement of the first phase of development. A fuller discussion of disposal site availability and transport of hazardous wastes can be found in the Mitigation Program./8/

Excavation, dredging, and trucking may require temporary street closures and disturbances of existing industries, businesses, or residences. Trucks carrying hazardous wastes would be routed down major arterial streets to the nearest freeway access ramps -- via Third, Brannan, and Fifth Streets to the Bay-Bridge/I-80 ramp at the intersection of Fifth and Bryant Streets, or via Third and Brannan Streets to the I-280 ramp at the intersection of Sixth and Brannan Streets. Truck routes could be further refined, if necessary, to minimize conflict with existing and future on-site and off-site land uses as the Project Area develops.

Clean-up of hazardous materials discovered in the Project Area would be guided by federal, state and local laws. At the federal level, CERCLA and RCRA, and their amendments, are the primary legislative mandates that require remediation of hazardous facilities and contaminated properties (see the Hazardous Waste Regulation subsection of Appendix L. Hazardous Wastes, beginning on p. XIV.L.1). Much of the responsibility for implementing these laws has been delegated by EPA to the DOHS, the State Water Resources Control Board (SWRCB), and the Regional Water Quality Control Board

(RWQCB). Within the responsibility of both past and present property owners, contaminated sites must be cleaned up to the standards of the concerned agencies. At the local level, San Francisco's Hazardous Soils Analysis Ordinance requires a site history and site soil analysis for properties suspected of being contaminated with hazardous materials. This information must be provided, and a mitigation plan submitted to and approved by the DOHS and RWQCB, before building permits will be granted by the City.

Public Health Risk

Sensitive Receptors

Of the four types of hazardous materials, the chemicals in the toxic group pose the most serious concern for health-related impacts in the Project Area; all of the materials in this group are poisons and pose a hazard to humans and wildlife--some severely so./11,12,14,15/ Section IV of the Mitigation Program describes the potential health effects of these materials. If not located and treated or removed, these toxic substances could pose long-term health hazardous to clean-up crews and construction workers, as well as future residents, workers, and visitors. The most hazard-sensitive land uses included in the Alternatives would be recreational open space and residential areas. In addition, fish, songbirds, waterfowl, and other wildlife would be at risk from these materials, either from direct contact with hazardous chemicals or solutions of hazardous chemicals, or by taking up the toxics by inhalation or by ingestion with their food supply./11/ Commercial and industrial land uses would be less sensitive to the presence of hazardous waste contamination.

Types of Health Risks

As a group, these toxic materials cause the complete spectrum of acute biological ailments, from mild discomforts through various respiratory, gastric, and metabolic dysfunctions, to severe distress and death./15/ Chronic or delayed effects include cancer and birth defects in both animals and humans./11,14/ For most toxic compounds, the health risk is related to the level or frequency of exposure. Many compounds appear to have thresholds below which there is no observable effect. For other materials, however -- especially carcinogenic materials -- the threshold concentration appears to be zero (i.e., exposure to any concentration at any frequency is a health risk).

As an example of one type of toxic effect, if fumes were produced from a damaged or leaking container of benzene, inhalation of the fumes by clean-up crews, construction workers, or residents of the Project Area could cause dizziness, headache, respiratory congestion, and, eventually, loss of consciousness. This could occur with a single exposure of a few minutes' duration. Acute or repeated exposures to benzene are known to damage the liver and cause leukemia in humans. In addition, benzene is toxic to aquatic wildlife when dissolved in very low concentrations in water. Leaking containers of benzene would also be a serious fire hazard./11,14,15/

- As another example, if residual DDT were present in soils in the Project Area, and if playing children should ingest soil particles contaminated with DDT, then symptoms could include facial tingling, headache, malaise, sore throat, and fatigue. Repeated or additional ingestion could produce tremors, confusion, paralysis, and coma in persons so exposed. As with all toxics, the severity of the reaction depends on the level of exposure, and the body weight and metabolism of the victim. For DDT, toxic effects would be seen after a single exposure to particulates in soil at a concentration of 500 ppm. The primary threat of DDT, however, results from its chronic toxicity and its potential to accumulate in body fats in both animals and humans. In addition to DDT's acute effects, this pesticide (now banned from use in the United States) can accumulate in the body and cause cancer and birth defects. DDT passes up the food chain and has been known to cause severe mortality to raptor eggs and chicks./11,14,15/

Table VI.N.2, p.VI.N.19 identifies hazardous materials potentially present in the Project Area, and indicates their reactive, ignitable, corrosive, and toxic properties. Known carcinogens and bioaccumulative toxics are also noted in that table.

Clean-up of any hazardous facilities or materials found in the Project Area, as described in the Mitigation Program, would itself carry some potential for public health impacts. Those impacts would depend to a large extent on the nature and amounts of material encountered, and the period during which clean-up were to take place. Direct hazards could be faced by clean-up crews and transportation workers./21,22,23/ Clean-up would pose indirect hazardous to nearby residents, businesses, visitors, wildlife, and others that might come in contact with fugitive materials at or near the clean-up site, or in transit. Without clean-up, however, existing risks to public health posed by hazardous materials would remain indefinitely.

There exists a related potential hazard to all involved parties from hazardous substances that might be overlooked during site survey and clean-up activities. Any overlooked materials might persist in the Project Area and pose a continuing, long-term hazard to construction workers, occupants, visitors, or wildlife in future years. For example, if any tanks of corrosive, reactive, or ignitable chemicals were not removed from the Project Area, the risk of accidental breaching or eventual leakage of their contents would always exist, leading to the additional possibility of fire or explosion. This danger would be a risk not only to clean-up crews and construction workers, but to residents as well./22,23/

If substantial amounts of friable asbestos or PCBs remained undetected in soils at the site, the risk of cancer would persist over the long term./11/ Herbicides such as 2,4-D and 2,4,5-T, present as residues contaminated with trace amounts of dioxins, could pose a similar hazard./18/ Those materials may be widespread in rail yards that have been defoliated; were those soils not to be cleaned up, a serious, long-term health risk would persist. If contaminants such as selenium salts or DDT persisted in the wetland areas in Alternative B, waterfowl and other wildlife might be subject to birth defects and deformities./9,16,24/

2000

Alternative A

All classes of hazardous materials are likely to be encountered in the portions of the Project Area to be developed by 2000. Lands to be developed include former oil industry operations at the southern tip of the site in parcels enclosed by 15th, Third, Mariposa and China Basin Streets; that is an area of potentially high contamination. Those parcels would be developed as S/LI/RD.

Both existing permitted hazardous waste generators (H&H Ship Service Co. and Pacific Motor Trucking Co.) are within the development area encompassed by Alternative A in 2000. The site occupied by the former is projected to be parkland and the latter would be MDR; investigation of those areas for hazardous wastes and any necessary remedial work would occur prior to development. Parcels in the center of the Project Area previously occupied by the former Southern Pacific rail yards -- areas potentially heavily contaminated with oils and pesticides -- would be developed predominantly for housing.

Projected excavated and dredged material volumes for this Alternative are intermediate between those of Alternatives B and N. Parcels to be excavated may be contaminated with toxic aromatic hydrocarbons, pesticides, wood preservatives, and heavy metal compounds. Containers of various chemicals also may be present, as well as soils contaminated with oil or fuel spills.

Initial Phase of Development. Lands to be developed in the initial phase include the northern corner of the Project Area, used in the past for shipbuilding, glass manufacturing, lumber yards, and rail-related uses, and the north-central portion of the Project Area used for rail-related uses. Parcels to be excavated may contain aromatic hydrocarbons, pesticides, wood preservatives, and heavy metal compounds. Soils could be contaminated with oil or fuel spills. The initial phase would include offices, open space, and MDR uses in those areas. The parcels to be developed and an adequate buffer zone would be investigated for hazardous wastes under the Mitigation Program, and any remedial action would be completed prior to development.

Dredging would occur in the initial phase of development to modify the edges of China Basin Channel. Sediments in the channel are known to be contaminated with a variety of materials--some of them hazardous--that have been transported into the channel from local surface runoff from dumping, and from flows from sewer outfalls. Dredging is described in VI.L. Hydrology and Water Quality, beginning on p. VI.L.24.

Alternative B

All groups of hazardous contaminants, with the possible exception of organic solvents, could occur in the area to be developed in 2000. One of the two existing permitted hazardous waste generators (Pacific Motor Trucking Co.) would be developed as MDR. The site of the former glass works near Third and Townsend Streets would become HDR. The rail yard bounded by Fourth, Townsend, Fifth and Berry Streets, currently occupied in part by the CalTrain commute station, would also be developed as HDR.

Excavation requirements, including dry dredging for wetlands, would be greatest for this Alternative, potentially maximizing the likelihood of encountering hazardous substances in substrate or groundwater. Disposal of excavated material from dry dredging would be subject to the same regulatory process as other land excavation discussed in this report. Many of the sites in the Project Area to be excavated, including the mid-channel wetland area, lie in the portion of the Project Area used as the city dump from about 1870 to about 1895. While that area probably would not contain buried pesticides or modern industrial contaminants, the former dump may contain a variety of materials such as metals, household solvents, and other chemicals, some in sealed containers. Parcels to be excavated may be contaminated with toxic aromatic hydrocarbons, pesticides, wood preservatives, and heavy metal compounds. Containers of various chemicals also may be present, as well as soils contaminated with oil or fuel spills. The groundwater in this area may be contaminated with such materials.

Alternative B, with its larger excavation requirements, would have a slightly greater potential than Alternative A to encounter subsurface hazardous waste deposits, underground storage tanks, or buried waste containers by the year 2000.

Initial Phase of Development. Portions of the Project Area that would be included in the initial phase of development once supported chemical, oil storage, and rail industries, and now support junkyards, among other industrial and warehouse uses. In addition, the initial phase of development would include portions of the former city dump. The former dump may contain metals, household solvents, and other chemicals. Parcels to be excavated may be contaminated by aromatic hydrocarbons, pesticides, wood preservatives, and heavy metals. The initial phase of development would include parkland and wetlands, offices, and MDR uses. The parcels to be developed in the initial phase and an adequate buffer zone would be investigated for hazardous wastes under the Mitigation Program, and any remedial action would be completed prior to development.

Alternative N

Excavation requirements would be less for this Alternative, and no dredging is planned. As with Alternatives A and B, however, all groups of hazardous contaminants could be encountered. The block bounded by Third, Townsend, Fourth, and King Streets -- the site of the former glass works -- would be developed as offices; the remainder of the land north of China Basin Channel would be little changed. Some retail and M-2 Industrial space would be developed in the Banana Triangle near the intersection of Third and Fourth Streets. Most of the Project Area would undergo little change in use. Rail yard use basically would be unchanged. Neither of the currently permitted waste generating facilities would be affected.

Impacts associated with excavation and dredging activities would be less than for Alternatives A and B. Alternative N is not master-planned and would not provide an opportunity for site investigation and remediation of hazardous wastes contamination in a comprehensive and coordinated manner, as under the Mitigation Program. Site investigations under Alternative N would not include an Areawide Survey of the entire Project Area, nor would they necessarily include buffer zones. Therefore, the potentials for: exposure of construction workers and project occupants to previously undiscovered wastes during excavation and grading; continued leaching of waste materials into the groundwater; and conflict between remediation efforts and ongoing activities of houseboat residents and project employees would be greater than for Alternatives A and B. Under Alternative N, the Project Area would still be investigated for hazardous waste, one development site at a time, under the provisions of the Hazardous Soils Analysis Ordinance.

Build-Out/2020

By 2020, distinctions between Alternatives A and B regarding hazardous materials would be minor, because, except for one Port-Related/M-2 parcel in Alternative A, the entire Project Area would be redeveloped. Alternative N, however, would have less new construction, possibly delaying clean-up. More existing land uses and structures probably would remain into the indefinite future.

Between 2001 and 2020, portions of the Project Area under all Alternatives would be undergoing development after increasingly larger portions were completed and occupied by residences, businesses, offices, and industries. Uncertainties regarding transport of hazardous materials to off-site disposal repositories, discussed above for 2000, would be more critical in the period between 2001 and 2020 (on the assumption that no new technologies for treatment of hazardous wastes are developed).

Alternative A

The extensive rail yards north of China Basin Channel that formerly held paint, oil storage, lumber, and shipbuilding industries, as well as portions of the city dump, would be converted to offices and S/LI/RD, with some HDR near the channel. The center of the Project Area that remained undeveloped by 2000 would be developed primarily into MHDR and MDR. The southern section of the Project Area (south of 16th Street) that formerly held paint industries and the Southern Pacific Railroad roundhouse, would be developed as S/LI/RD.

Alternative B

Alternative B would include development of the extensive rail yards north of China Basin Channel with MHDR and open space. The parcels containing the sites of the old railroad roundhouse and the former paint and glass industries in the southern portion of the site also would be developed as MHDR. The southeastern corner of the Project Area that received heavy oil-industry use would become MHDR and S/LI/RD.

Alternative B, with its greater excavation requirements for wetland creation, would have slightly more potential for health impacts than Alternative A because of the greater disturbances of potentially contaminated groundwater. Differences between Alternatives A and B, however, would be minimal because of requirements to test for hazardous wastes throughout the Project Area and to subsequently clean up any wastes discovered.

Alternative N

Alternative N would retain much of the existing rail yard use on the northern and western portions of the Project Area. The remainder of the Project Area would be primarily M-2 Industrial and Port-Related/M-2. In that regard, the potential for public health exposure from hazardous waste deposits would be less critical in this Alternative. The variations in rail yard development and heavy industry use between Alternatives A and B and Alternative N are the major differences by 2020 among the three Alternatives. In Alternative N, the Project Area might not be cleaned up until after 2020. If existing uses remain, and they might remain especially under Port-Related/M-2 use, then those parcels may not get timely clean-up.

Because Alternative N would not provide an opportunity for site investigation and remediation of hazardous wastes contamination in a comprehensive and coordinated manner and buffer zones might not be required, the potentials for: exposure of construction workers and occupants to previously undiscovered wastes during excavation and grading; continued leaching of waste materials into the groundwater; and conflicts between remediation efforts and ongoing activities of houseboat residents and Project Area employees would be greater than for Alternatives A and B. Under Alternative N, portions of the Project Area would still be investigated for hazardous wastes, as sites were redeveloped in piecemeal fashion, under the provisions of the Hazardous Soils Analysis Ordinance.

MITIGATION

HAZARDOUS WASTE POTENTIAL

This subsection describes in general terms the types and sequence of activities necessary to ensure that the Project Area is free of substantial industrial hazards prior to initiation of development. This subsection is, in large part, a summary of the mitigation recommendations contained in the draft Mission Bay Project Hazards Mitigation Program (the Mitigation Program). Measures N.1 and N.2 apply specifically to master-planned Alternatives A and B. For those two Alternatives, the Project Area would undergo a preliminary Areawide Survey of surface soils and soil gases, and a parcel-by-parcel subsurface soils and groundwater characterization, which would together constitute a comprehensive approach to remedial action. The Areawide Survey would cover the entire Project Area at the beginning of the project, and detailed Development Phase Area (DPA) Investigations would characterize specific portions of the Project Area in depth prior to their being developed. For Alternative N, no Areawide Survey would be required, and development would occur in a piecemeal fashion, which could result in partial or incomplete clean-up of the Project Area as a whole. All site investigations and any necessary remedial work under all Alternatives would be carried out in full compliance with all applicable laws and regulations. Site investigations are not expected to generate substantial adverse impacts. Depending on the technology used, remedial work could result in such impacts; however, these could require additional public health agency or environmental review.

Clean-up of Hazardous Materials

Measure	Alternative	Description
N.1	A,B	Comprehensive Areawide Survey. Evaluate the entire Project Area to locate and identify hazardous wastes deposited on the site. The Areawide Survey would cover the entire Project Area prior to the beginning of the first phase of development. it would include surface sampling and chemical analyses, and a subsurface soil-gas survey. The major objective of the Areawide Survey would be to identify possible chemical hazards in areas not being

Measure	Alternative	Description
		developed first, but which could pose a hazard during construction or subsequent habitation of the first phase of development in the Project Area. Those potential hazards have been identified as toxic substances at the land surface (which could present a hazardous exposure through dermal contact, ingestion or inhalation), toxic gases, and possible explosion hazards. The Areawide Survey would also include installation of monitoring wells at the perimeter of the Project Area to identify possible migration of contaminants into or out from the Project Area.
N.2	A,B	Development Phase Area Surveys. Evaluate in detail portions of the Project Area to be developed to characterize hazardous wastes prior to each phase of development. This investigation would include Stages 1 and 2 of the Mitigation Program. Comprehensive subsurface investigation of the DPAs corresponding to each phase of development (part of Stage 1 investigations for the DPA Investigations) would include drilling and sampling of soil borings and monitoring wells; geophysical surveys to locate possible buried tanks, piping and utilities; and other activities. The major purpose of the detailed, comprehensive subsurface DPA Investigations planned for each development area just prior to development would be to initiate and focus the remediation program for chemical hazards in the areas planned for development. Additionally, buffer zones would be established around the specific development areas which would also undergo comprehensive subsurface investigation at the same time. These buffer zones would be included to provide a mechanism for discovering and remediating potential chemical hazardous directly adjacent to a given development area before that area was inhabited. Use of such buffer zones would reduce the likelihood that in the

Measure	Alternative	Description
		future hazardous substances would be excavated or remediated adjacent to an already-developed area.
		A 300- to 500-foot buffer zone is proposed for each DPA Investigation in the Mission Bay Project Area. The size of the actual buffer zone for each DPA would vary depending on the location and proposed uses of the development area. For industrial, commercial and office uses, the buffer zone would be 300 feet; for residential uses the buffer zone would be 500 feet, except that in both cases the buffer zone would stop at a significant barrier, such as China Basin Channel or the border of a site which has already been investigated or developed. Buffer zones would not extend outside of the Project Area into adjacent land parcels.
		Surface samples would include soil samples and samples of foreign materials. Subsurface samples would include subsurface soil samples, soil gas samples, samples of subsurface foreign materials, and groundwater samples. In addition, an electromagnetic survey of underground storage tanks (USTs) would be carried out. Analytical methods to be applied to site samples would consist primarily of laboratory analyses by EPA-approved analytical methods that provide quantitative analytical results.
N.3	A,B	Coordinated Site Remediation. Develop separate site remediation plans for individual subareas within the Project Area to deal specifically with contaminants of concern detected during site sampling, in accordance with applicable State and Federal guidance for site clean-up. The primary objectives of site remediation would be to eliminate existing public health hazards and to minimize

the potential for future risks to public health and safety. These objectives would be achieved by preventing human contact with contaminated air, soil, or groundwater and by preventing migration of hazardous materials in air, soil, or groundwater. A secondary objective would be to minimize potential adverse effects on the environment, such as pollution of the Bay.

On the basis of federal and state guidelines, five categories of alternatives are to be considered in developing remedial activities./25/ These are:

1). Alternatives for treatment or disposal at an off-site facility;

2). Alternatives that attain applicable or relevant and appropriate public health and environmental requirements;

3). Alternatives that exceed such requirements;

4). Alternatives that do not attain requirements but would provide significant protection for public health and the environment;

5). No-action alternative.

Alternative clean-up measures might include soil removal, on-site containment, and on-site treatment (stabilization, extraction, incineration, or similar methods). For groundwater clean-up, measures might include groundwater pumping (dewatering), air stripping, extraction, and filtration.

Selection of remedial action alternatives and scheduling of remedial activities would be coordinated with plans and schedules for project development. Immediate risks to public health or wildlife would be addressed before

Measure	Alternative	Description
		initiation of site development. Where possible, remedial activities would be selected and planned to minimize interference with the project schedule. Approval of remedial plans would be sought at various stages of plan development by meetings among the project sponsor, contractors, and regulatory agency personnel. Recommendations for coordination with governmental agencies are presented in the Mitigation Program. To ensure good agency coordination, in addition to agency review and approval of cleanup plans, form an advisory panel consisting of the project sponsor, the agencies with specific or general jurisdiction over the Project Area or project development activities, city agencies, and other major and adjacent landowners such as the Port of San Francisco. This advisory panel would meet monthly to be advised of current activities on the site, review cleanup plans prior to implementation, and discuss other project-related issues that arose during site remediation.
• N.3a	A,B	Divide the Project Area into specifically delineated development phase areas for purposes of in-depth investigations, which would define the minimum area that must be investigated for toxic contamination prior to allowing development to proceed on any property in that area.
•		Prior to approving any development activity (e.g., final or subsequent tentative subdivision map, building permit) within any given development phase area, require completion of an in-depth investigation of: (1) the entire development phase area; (2) a 300-500-foot buffer zone around the development phase area; and (3) any areas designated for infrastructure linked to the sites proposed for development.

Measure	Alternative	Description
•		This approach would ensure that the City had detailed information concerning the location and extent of hazardous substances in a development phase area and in a buffer zone around the development phase area prior to authorizing any development activities in an identified development phase area. The delineation of the development phase areas for investigation purposes prior to Project development would make the process more predictable.
•		A preliminary map dividing the Project Area into delineated development phase areas for the purposes of hazardous waste investigation is shown in Figure XV.L.1, on p. XV.L.7 of Volume Four.
• N.3b	A,B	Require that each Remedial Action Plan for a development phase area and its buffer zone include an implementation schedule which will take into consideration the anticipated sequence of development, the prospective use and occupancy of sites which may be affected by remediation activities, the street and traffic patterns, and the nature of the remediation measures proposed. Thus, the remediation schedule could be formulated to avoid or minimize adverse environmental effects.
• N.3c	A,B	Require that the project sponsor take steps necessary to secure undeveloped areas and certain existing uses in order to prevent unauthorized access.
• N.3d	A,B	Require that once development of a portion of the Project Area is initiated, that it be pursued diligently to completion. In the same way that a City can require bonds or other financial security for completion of infrastructure

Measure	Alternative	Description
•		and public facilities necessary to serve a proposed development, the City could require bonds or other financial security to ensure completion of investigation and remediation once initiated.
• N.3e	A,B	Also require that the area covered by an in-depth site investigation include all uses which are linked for planning reasons. For example, prior to issuing a building permit for an office project, the City could require site investigation and, if necessary, a remedial action plan for the areas where housing linked to that office project is to be developed (including areas where parks and infrastructure necessary to serve the residential use will be located). This approach would ensure that hazards remediation would not be an impediment to the development of a balance of uses at any given stage of Project implementation.
•		This measure cannot, of course, ensure that the whole Project Area will be developed precisely according to whichever Plan Alternative is selected. The land owner retains the right to seek amendments to the development plan. The City, however, has discretion to approve or disapprove proposed amendments in whole or in part.
• N.3f	A,B	Require that the in-depth investigation be completed, and the costs of remediation be secured, if necessary remediation is not already implemented, as a condition to issuance of the final subdivision map(s).
• N.3g	A,B	The City could require that all necessary remediation of land designated for linked housing, public facilities, infrastructure, parks, etc. be implemented or secured as a

Measure	Alternative	Description
		condition of approval of final subdivision maps or building permits. Thus, the City could be assured that prior to its accepting a dedication of property, the property would be thoroughly investigated, remediated, and improved.
N.4	N	Implement a planned, systematic cleanup of the entire Project Area for Alternative N, as recommended in Measures N.1 and N.2 for Alternatives A and B. Such an approach would greatly reduce the potential for public health impacts on construction workers, Project Area employees, and residents. Alternative N, because it is the No-Project Alternative and does not assume development would occur in the context of a coordinated development plan, would not afford the opportunity for such an approach. However, clean-up would proceed under existing laws and regulations on a parcel-by-parcel basis as new development were undertaken.
N.5	A,B,N	Implement the following safety measures at cleanup sites to protect workers on the clean-up sites and other individuals living and working near the cleanup sites from hazardous airborne dust and toxic gases that could be released:
N.5a		Prevent direct contact with hazardous soils or liquids by the on-site workers with the proper selection of safety clothing and equipment. The level of safety equipment required would be determined on a site-by-site basis. The level of safety equipment required (i.e. A,B,C) would be specified by site clean-up plans. Different safety levels could require disposable clothing, safety boots, safety gloves and respirators. This mitigation would protect on-site workers.

Measure	Alternative	Description
N.5b		Implement a dust control program similar to mitigation measure F.1 in the Air Quality section, if the dust from a site would otherwise be hazardous to on-site workers or nearby residents. The specific site clean-up techniques would determine the dust control measures to be implemented in a particular dust control program. The dust control program would require both routine and random oversight by an industrial hygienist. The industrial hygienist would make measurements, if necessary, to determine that resultant exposure levels to dusts are within appropriate standards. This mitigation would protect both on-site workers and off-site individuals.
N.5c		Create a safety buffer zone around the clean-up site if an on-site clean-up involves activities that present the risk of a toxic gas release. The size of the safety buffer zone must be large enough so that the immediate release of gases would not put off-site individuals in danger. This mitigation would protect off-site individuals.
N.5d		Develop an evacuation plan before drilling or excavation in dangerous areas. This plan would require that safety actions (including evacuation) be taken if a gas release was of a long-term nature, or larger than expected. This mitigation will protect off-site individuals.
N.5e		Require on-site clean-up crews to monitor odors and fumes with appropriate explosive gas detectors or organic vapor analyzers. This mitigation will protect both on-site workers and off-site individuals.

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MITIGATION

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O. GROWTH INDUCEMENT

IMPACT

This section provides a summary of implications of the Mission Bay Alternatives for growth in the City and the Bay Area region. Most growth inducement effects are described elsewhere in the EIR in terms of implications for citywide and regional growth and development patterns as well as implications for Nearby Areas. Those more detailed discussions are summarized and referenced here.

There are four main issues involved in considering the growth-inducing effects of large-scale development such as that represented by the Mission Bay Alternatives:

- "Net addition": the extent to which Project Area development would result in growth of business activity and employment or housing and population that otherwise would not occur in the City (or the region);
- The growth-inducing relationship between increases in employment and associated increases in population;
- The "multiplier" effect: "multiplier" is an economic term to describe inter-relationships among various sectors of economic activity. Consideration of the multiplier effect is an acknowledgement that Project Area employment and population growth is not the complete picture of growth from a broader perspective; and
- The "spillover" effect of Project Area development: the extent to which Mission Bay Alternatives would result in growth and change that otherwise might not be expected in areas near the Project Area.

Growth inducement issues are addressed for the Alternatives at full build-out. The discussion is organized according to the four main issues described above and not by Alternative. With this approach, the discussion focuses on comparison of Alternatives for each issue.

NET ADDITION

Development of the Mission Bay Alternatives would accommodate growth of business activity / employment and housing / population in the Project Area. Whether or not that growth would represent a net addition to economic activity in the City or region depends on location options for businesses and for housing development. Mission Bay development would contribute to increases in activity to the extent the Project Area would provide a location for business expansion and/or residential development that otherwise would not occur in the City or the region. Shifts in economic activity from one location to another (such as corporate relocations to the suburbs) may have distributional and local implications (e.g., economic loss for San Francisco, gain for suburban communities) but do not affect the overall level of activity in the area of interest (the region, in that example).

Net Addition of Business Activity and Employment

There would be growth of business activity and employment in the Project Area and in the City with all Mission Bay Alternatives. An Alternative would result in a net employment gain for the City (compared to another Alternative) if it would accommodate business activity and employment that had no other location options in the City, i.e., business activity and employment that would be in the City only as a consequence of the choice of that Alternative. Since some businesses that would locate in Mission Bay would have other location options in the City, some of the employment growth associated with Mission Bay development would not represent a net addition to citywide economic activity. Differences between citywide employment scenarios for each Alternative indicate the magnitude of the net addition to citywide employment of one Alternative compared to another.

The difference between the citywide scenario for the Alternative with the most employment growth (Alternative A) and the scenario for the Alternative with the least employment growth (Alternative B) would be about 9,200 more jobs in the City at build-out/2020 (see Table VI.B.27, p. VI.B.77). Mission Bay development under Alternative A would add about 5% more to citywide employment growth than would Mission Bay development under Alternative B. Since the citywide employment scenario for Alternative N would fall in between the scenarios for Alternatives A and B, comparing each of those Alternatives to Alternative N would indicate an even smaller difference in citywide employment growth. Compared to Alternative N, the changes in planning policy and zoning represented by Alternative A would result in about 3,300 more jobs in the City, about 2% more employment growth. Compared to Alternative N, the changes represented by Alternative B would result in about 5,900 fewer jobs in the City, about 3% less employment growth.

The differences between the scenarios of citywide employment for each Alternative are less than the differences in Project Area employment because some businesses that would locate in Mission Bay have other location options in the City, at least for a long time into the future. Consequently, much of what is counted as employment growth in the

Project Area in the scenario for one Alternative is counted as employment growth elsewhere in the City in the scenario for another Alternative. Thus, the choice between Alternatives would affect locations for development and business activity as well as the amount of development and business activity in the City. (See Implications for Nearby Areas, in VI.B. Land Use, Business Activity, and Employment, p. VI.B.106, for comparison of the scenarios for each Alternative in terms of the distribution of economic activity in areas surrounding Mission Bay.)

Mission Bay under all Alternatives would contribute to future regional employment growth. With the exception of potentially a few cases, business activity, and employment in Mission Bay would not represent a net addition to total regional economic activity, however. That is because most of the businesses likely to locate in Mission Bay would have other location options elsewhere in the region if not in San Francisco. Therefore, more growth of business activity and employment in Mission Bay in one Alternative compared to another represents the shift of economic growth from locations elsewhere in the region to the Mission Bay Project Area. There could be a few cases of businesses choosing Mission Bay as their only Bay Area location. That would be most likely with Alternative A. Such businesses would be back-office operations, light industrial companies, research and development, or institutional facilities that otherwise might choose locations near Stockton or Sacramento or in Southern California. The net addition to regional employment represented by only a few businesses would be small. (See Implications for Citywide and Regional Growth and Development Patterns, in VI.B., p. VI.B.119, for more detailed discussion.)

Net Addition of Housing and Population

The citywide scenarios show housing and population growth with all Alternatives. There would be more growth in the scenarios for Alternatives A and B than there would be in the scenario for Alternative N, since the latter results in no new housing development in the Project Area. (There would be somewhat more housing development outside the Project Area with Alternative N--primarily in small infill projects--but the number of additional units would be small relative to the large number of units in the Project Area under Alternatives A or B.) Chapter VII. Variations on Alternatives, p. VII.1, discusses a housing variant of Alternative N.

The citywide housing and population scenarios illustrate the contribution each Alternative would make (see Table VI.C.11, p. VI.C.47). Alternative B, with the most Project Area housing, would result in 8,800 more housing units in the City at build-out than would Alternative N. In other words, compared to Alternative N, Alternative B would result in a net addition of 8,800 units, or 30% more housing growth in the City. Alternative A would result in 6,400 more housing units in the City at build-out (about 22% more housing growth) than would Alternative N. The net addition with Alternative B would be greater than that with Alternative A.

The choice between Alternatives makes proportionally more difference for the net addition of housing in the City than it does for the net addition of employment. Where Alternative B (most total housing / population) would represent an addition of about 30% more housing in the City compared to Alternative N (least total housing / population), Alternative A (most total employment) would represent an addition of 5% more jobs in the City compared to Alternative B (least total employment).

The reason for the difference between housing and employment in terms of net addition to the City is that there are more location options in San Francisco for businesses and commercial development than there are for residential development. That conclusion is based on current plans, policies and zoning as set forth in the Commerce and Industry and Residence Elements of the San Francisco Master Plan, as well as special area plans. Under current zoning, the capacity of the City's land to accommodate commercial development is much greater than its capacity to accommodate residential development. Thus, opportunities for business expansion and employment growth in the City, but outside the Project Area, are greater than opportunities for housing development. Consequently, through the analysis period, Mission Bay Alternatives that re-zone the Project Area for a substantial amount of residential development (Alternatives A and B) would contribute relatively more to the net addition of housing / population in the City than Alternatives with the largest amounts of commercial development in the Project Area would contribute to the net addition of business activity / employment in San Francisco.

For some time into the future, there would not be much difference between the scenarios for each Mission Bay Alternative in terms of a net addition of housing and population in the region. There are a variety of location options elsewhere in the region for residential development. Consequently, the choice between Mission Bay Alternatives would affect the distribution of housing / population growth within the region, but not the amount of growth.

From a longer-term perspective, however, there could be differences between the regional scenarios for each Alternative. When considered in terms of the capacity of the region's land to accommodate residential development as prescribed by local zoning policy, Mission Bay Alternatives that re-zoned industrially zoned land for housing would expand the overall capacity for residential development in the region. Thus, over the longer term, assuming all other factors to be equal, Alternatives A and B would result in a net addition to the region's housing supply (i.e., adding housing that otherwise could not be built in the region) compared to Alternative N. The net addition would be greater with Alternative B than with Alternative A.

RELATIONSHIP BETWEEN EMPLOYMENT GROWTH AND POPULATION

Employment growth can induce population growth, thereby stimulating housing demand and demand for community facilities and infrastructure. Increases in employment require workers to fill the new jobs. The additional workers come from several sources: new residents in the area, people joining the labor force (e.g., having finished school, deciding to return to work or taking a job for the first time) and unemployed people finding jobs. The first source mentioned (new residents in the area) represents the population growth "induced" by employment growth.

For comparing the Mission Bay Alternatives from the perspective of population growth inducement, it is necessary first to determine net additional employment growth associated with each Alternative. If the employment growth is not dependent on Mission Bay development, i.e., if it would occur elsewhere in the City or region if not in Mission Bay, then population growth associated with that employment growth cannot be attributed solely to Mission Bay development. This leads to analysis of the cumulative scenarios for each Alternative, since they reflect overall patterns of employment growth. Those scenarios can be used to identify the net gain in employment associated with one Alternative compared to another.

As described above, p. VI.O.3, the Alternatives would make little difference in total regional employment. The amount of employment growth in the Bay Area through build-out/2020 would be essentially the same in the scenarios for each Alternative. Therefore, from the cumulative perspective, it can be concluded that the choice of one Mission Bay Alternative over another would not result in more or less growth-induced population attributable to employment growth. In other words, employment growth in the scenarios for all Alternatives would induce about the same amount of population growth.

The second growth-inducement consideration is locational. There would be differences between the scenarios in the locations of employment growth throughout the region. Those differences would lead to different locational implications for induced population growth (and associated housing demand and other public service and infrastructure requirements).

The differences between the scenarios for each Alternative in terms of regional employment growth and development patterns are described in VI.B. Land Use, Business Activity, and Employment, pp. VI.B.119-VI.B.123. Alternative A would concentrate the most business activity and employment in San Francisco. By comparison to the other Alternatives, less of total expected regional employment growth would occur in parts of the region outside San Francisco. The scenario for Alternative B represents the other extreme. Without much commercial / industrial development in the Project Area, some expected business activity and employment would locate elsewhere in San Francisco; other activity and employment would locate in other parts of the region outside the City. Regional economic activity would be most dispersed in the scenario for Alternative B, compared to the scenarios for the other Alternatives. The scenario for Alternative N falls in between those extremes: business activity and employment growth would be more dispersed than in the scenario for Alternative A and less dispersed than in the scenario for Alternative B.

Those different patterns for the location of business activity and employment growth throughout the region have implications for induced population growth. Although the amount of population growth induced by employment growth would not differ between the scenarios, the locations of where that population growth and associated impacts would occur would vary. Generally, following the discussion in VI.B. (summarized above), Alternative A would result in relatively more induced population growth and associated housing and other service demands centered on San Francisco and relatively less in the rest of the region, compared to the other Alternatives. Alternative B would result in more induced growth and impacts dispersed throughout the region and less in San Francisco. Alternative N would result in more induced effects in the City than would Alternative B and more induced effects in the rest of the region than would Alternative A.

As in the case of multiplier effects, population growth-inducing effects are accounted for in the cumulative scenarios of employment and population used in the EIR. The economic forecasts rely on population growth and labor force growth to sustain employment growth.

MULTIPLIER EFFECTS

Multiplier effects account for those economic inter-relationships through which businesses of certain types support other businesses, business activity supports household spending, and household spending generates sales and economic activity. Future economic activity in Mission Bay under all Alternatives would be related to economic activity elsewhere in the City and the region. Some Mission Bay activity would have multiplier effects, supporting businesses outside the Project Area. Project Area businesses would provide sales and support employment growth in other businesses located elsewhere in the Downtown & Vicinity, in areas west and south of the Project Area and outside the City, through purchases of supplies, services, or equipment. Project Area and related business activity would provide wages and salaries that support household spending for consumer goods and services.

Conversely, some economic activity in Mission Bay would be supported by the multiplier effect of businesses located outside the Project Area. For example, downtown offices or hotels could be customers of businesses likely to locate in the Project Area. Thus, not all Mission Bay commercial and industrial development would generate economic activity through multiplier effects. Some would accommodate multiplier activity generated from other locations. That conclusion would hold for all Alternatives.

There would be differences between Alternatives in the magnitude of multiplier effects associated with economic activity in the Project Area. Alternative A would generate the most, followed by Alternative N, then Alternative B.

Retail activity in the City will be affected by the spending of Project Area residents and workers. This is one aspect of the multiplier effects described above. Mission Bay development would contribute to growth and change in the City's retail sector in two ways. First, retail development in the Project Area would be supported by Project Area residents and workers and also would expand shopping and restaurant opportunities for those living and working outside Mission Bay. Estimates are provided on pp. VI.B.104–VI.B.106 of the amount of retail space that could be supported by spending by Project Area residents and workers for each Alternative. The analysis compares those amounts to the amount of retail space included in each Alternative for conclusions about the extent to which Project Area retail space would depend on spending from a larger market area. Second, retail spending outside Mission Bay by Project Area residents and workers would support sales growth in stores, restaurants, and specialized shopping areas elsewhere in the City. The effects of retail spending from Project Area residents and workers on nearby retail areas and in other parts of the City are described on p. VI.B.118.

The economic forecasting analysis for the Mission Bay EIR considered all the inter-relationships described above. The forecasts of employment for the Downtown & Vicinity, the total City and the region account for employment attributable to the multiplier effects of Project Area activity. Consequently, the cumulative impact analyses in the EIR account for any additional growth outside the Project Area that could be considered to be generated by Project Area activity.

SPILLOVER EFFECTS IN NEARBY AREAS

Spillover effects are the changes in economic activity in areas near Mission Bay that would result from the amount and type of Project Area development. Development of each Alternative would upgrade the land use character and types of activities in the Project Area, and would mean major changes in character in Alternatives A and B with substantial amounts of housing. Alternatives A and N would add substantially to business activity and employment in the southeastern part of the City. Alternatives A and B would result in improved transportation access to jobs in the Downtown & Vicinity for residents of the southeastern part of the City. Over time, Mission Bay development and associated infrastructure and public service improvements would affect the land use and residential character, as well as economic activity, in areas beyond Project Area boundaries.

Those areas (South of Market, Showplace Square, North Potrero, Potrero Hill, Lower Potrero, Central Bayfront, Inner Mission, and South Bayshore) are expected to change over time in any case. Development of Mission Bay would affect the pace of that change, and there would be differences between the scenarios for each Alternative in terms of the types of changes that would occur. Discussions under the heading Implications for Nearby Areas in VI.B. Land Use, Business Activity, and Employment, p. VI.B.106, and VI.C. Housing and Population, p. VI.C.86, describe the spillover effects of Mission Bay development and compare the changes expected in other areas as a result of activity in the Project Area with each Alternative. The issues and conclusions are summarized below.

In terms of business activity and employment, with all Alternatives, Mission Bay's upgrading of the type of space and type of activity in the Project Area gradually would increase the attractiveness of areas nearby, and they would become more desirable locations for a broader range of business activities. There would be differences between the Alternatives in land use change and employment growth in Nearby Areas, however, depending on the extent to which Project Area development would accommodate various demand groups. Since Alternative B would accommodate the smallest amount of commercial development and employment growth in the Project Area, it would result in the most demand for space over time in Nearby Areas. Compared to the other Alternatives, with Alternative B there would be more competition for space, more new development, pressure to increase commercial rents, and more changes for existing businesses in those areas. Generally, differences between Alternatives in Mission Bay office development would result in more or less effects on parts of the Downtown & Vicinity north of the Project Area, while differences in S/LI/RD or new M-2 Industrial development would result in more or less effects on Nearby Areas to the west and south.

In some instances, the location of new development in the Project Area would raise the issue of compatibility with adjacent development. For example, Mission Bay residential development east of Third Street (in Alternatives A and B) could conflict with potential container terminal development at Mission Rock / Pier 50 and with active maritime uses on piers east of the Project Area. The character of the South of Market area along Townsend Street would not be the same with Alternative A (Mission Bay office across Townsend Street) as it would with Alternative B (Mission Bay housing across Townsend Street).

In terms of housing and population, upgrading of the Project Area would have some spillover effects in Nearby Areas. The new Mission Bay residential neighborhood in Alternatives A and B would represent a dramatic change in land use in that part of the City. The result could be relatively more people attracted to the existing residential areas nearby than otherwise. On the other hand, large amounts of Mission Bay housing could absorb some of the demand for housing in San Francisco that otherwise would result in more demand for existing housing in Nearby Areas. Alternatives with large amounts of commercial development and employment in the Project Area (Alternative A and, to a lesser extent, Alternative N) would bring business activity that much closer to residential neighborhoods in the southeastern part of the City. That could translate into improved job opportunities and access to jobs for area residents. It also could result in more new residents and gentrification pressures. Those spillover effects would be more evident in adjacent Nearby Areas than they would be in more-distant areas. In the end, it is difficult to predict the direction of spillover effects from the housing / population perspective because features of each Alternative have implications that offset each other.

VII. VARIATIONS ON ALTERNATIVES

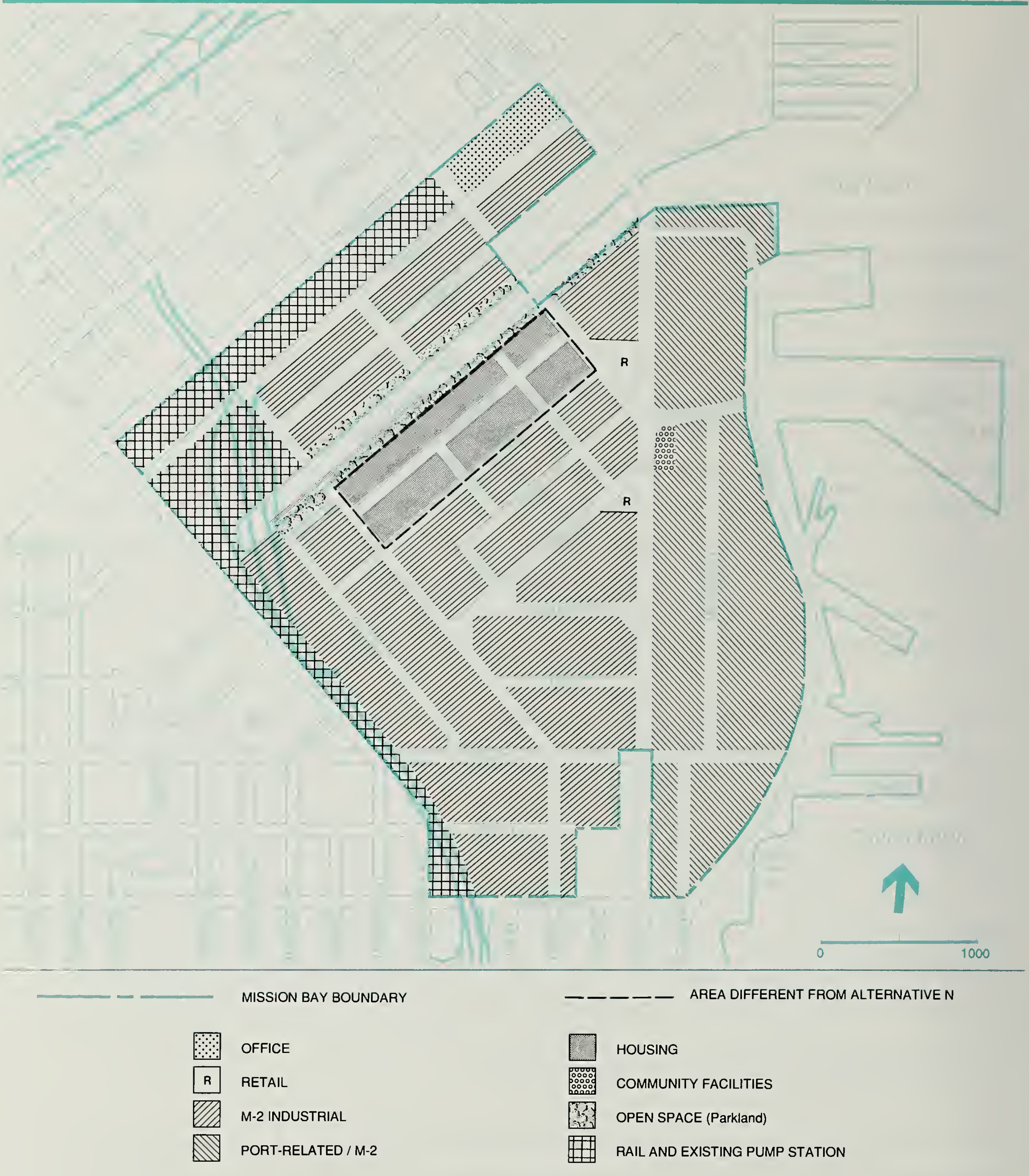
This chapter considers ten variations on the EIR Alternatives analyzed in Chapter VI. Environmental Setting, Impact and Mitigation. The discussion focuses on how the impacts of each variant would differ from those of the parent Alternatives.

Six variants on the land use programs and densities of the Alternatives are considered. The land use variants are: 1) adding 1,000 units of housing south of China Basin Channel to Alternative N; 2) replacing residential, open space and S/LI/RD uses east of Third Street in Alternative B with Port-Related/M-2 uses similar to those in Alternative N; 3) reducing housing density throughout the Project Area in Alternative B from 10,000 to 7,700 units; 4) replacing some S/LI/RD space in Alternative A with retail and personal and business services space, and increasing community facilities; 5) replacing some S/LI/RD space with office space in Alternative A; and 6) allowing an increase in height to 220 feet for some residential structures along Fifth Street in Alternative B.

Four other variants are also considered: 7) "Office as a Primary Use in S/LI/RD Space" assesses the implications of changing the S/LI/RD designation in Alternatives A and B to allow office as a primary use; 8) "Variations in the Percentage of Affordable Housing and the Size of Affordable Units" addresses the implications of varying the percentage of "affordable" housing developed in the Project Area in Alternatives A and B from the 30% level identified in the Mayor's Letter and also addresses the implications of building more larger units and fewer smaller units; 9) "CalTrain Station Location" discusses the effects of not relocating the CalTrain station to Seventh and Channel Streets as is proposed in Alternatives A and B; and 10) Reduced Seismic Hazard for Alternatives A, B, and N.

1. HOUSING DEVELOPMENT (ALTERNATIVE N)

The Central Waterfront Plan calls for development of a mixed-use neighborhood with predominantly residential uses south of the channel west of Third Street. In the future, such housing could occur in the Project Area similar to the almost 400 units that have developed in the formerly industrial Northeastern Waterfront. As shown in Figure VII.1, this variant would add approximately 1,000 housing units to Alternative N in several blocks south of the channel between Fourth and Sixth Streets. This housing would be MDR (910 units) and LDR (90 units), allowable as a Conditional Use under existing M-2 (Heavy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MISSION BAY BOUNDARY
AREA DIFFERENT FROM ALTERNATIVE N
OFFICE
R RETAIL
M-2 INDUSTRIAL
PORT-RELATED / M-2
HOUSING
COMMUNITY FACILITIES
OPEN SPACE (Parkland)
RAIL AND EXISTING PUMP STATION

Mission Bay

FIGURE VII.1
HOUSING DEVELOPMENT (ALTERNATIVE N)

SOURCE: Environmental Science Associates, Inc.

Industrial) zoning. Allowing for a 3.5% residential vacancy, this would add about 1,975 Project Area residents to the houseboat residents under Alternative N, for a total of about 2,010 persons.

The housing would occupy about 16.7 acres that would otherwise be used for about 725,000 square feet of M-2 space under Alternative N. For purposes of a conservative analysis of this variant, it is assumed that that amount of M-2 floor area would be built elsewhere within the Project Area (rather than being displaced) by developing the remaining M-2 Industrial blocks to greater density. Such an increase in density could be accommodated within the height and bulk assumptions developed for Alternative N./1/

PUBLIC PLANS, POLICIES AND PERMITS

The addition of housing to Alternative N would address Central Waterfront Plan objectives for the China Basin Subarea to promote new housing south of China Basin Channel (see Table VI.A.1, Residence Objective, p. VI.A.36, and China Basin Subarea Objective 3, Policy 2, p. VI.A.38). As with Alternative N, this variant would have some retail uses and community facilities that could serve the resident population and office and other non-industrial employment. By providing new housing, the variant would have a more diverse land use mix than Alternative N, but it would not fully respond to Central Waterfront Plan policies to create a mixed-use neighborhood on all surplus rail lands west of Third Street.

LAND USE, BUSINESS ACTIVITY, AND EMPLOYMENT

Among the EIR Alternatives, Alternative N would provide space in Mission Bay suitable for businesses similar to existing Project Area operations (see p. VI.B.82). The addition of housing in several blocks south of the channel would alter the function and character of those blocks. Additional Project Area residents would provide more support for local retail stores adjacent to or within the housing area. Alternative N would orient retail uses toward Third Street, serving the eating, drinking, and convenience shopping needs of workers, as well as providing sites suitable for larger-scale stores serving a larger market. This variant would include some smaller-scale residential-serving retail uses as well. No increase in total retail space is assumed.

Employment in the Project Area would be the same as for Alternative N, assuming the M-2 space displaced for housing would be built elsewhere in the Project Area (see

Table V.6, p. V.35), except for an increase of about 40 jobs associated with management, security and maintenance of the housing. Construction employment also would be higher than in Alternative N due to housing construction.

Introduction of housing into an industrial area could pose some land use conflicts with surrounding industrial uses depending on the types of activities occurring there; certain types of manufacturing operations or businesses involving nighttime operations or use of hazardous materials, for example, would not be compatible with housing.

The presence of housing could affect the types of uses that choose to locate in Mission Bay in the future. For example, housing uses would tend to make the area more attractive to small-scale office and retail uses than to industrial and distribution uses like those currently in the area.

HOUSING AND POPULATION

While Alternative N would make no contribution to expanding the City's supply of housing (see p. VI.C.67), this variant would add 1,000 housing units to that supply, helping to offset some of the demand for housing associated with Project Area employment growth. Total housing provided would be about 13% of the total in Alternative A and about 10% of the total in Alternative B, so less diversity in terms of household sizes, types and incomes would be expected (see p. VI.C.64).

- For office development in Alternative N, the City's OAHPP would require either payment of an in-lieu fee for production of housing or construction of about 580 housing units, about 360 to be affordable to households of moderate or lower income (see Table VI.C.17, p. VI.C.71). This variant could enable the developer of the office block to satisfy the number of units required by OAHPP in the Project Area (assuming the office developer could secure development rights to that land). Whether the OAHPP requirements for affordable housing could be met in the Project Area would depend on the prices and rents of the new units. Under the general price assumptions for affordable units from the Mayor's Letter, Project Area housing would not satisfy the revised OAHPP affordability requirements adopted in 1990.

- Overall employment growth in the Project Area would increase demand for housing in San Francisco. Housing sufficient to accommodate the increase in San Francisco households with Project Area workers in Alternative N would require about 2,100 housing units (see Table VI.C.18, p. VI.C.72), about 1,670 of which should be units priced at affordable levels (see Table VI.C.19, p. VI.C.73). The 1,000 units provided by this variant would supply about half that total demand. The extent to which affordable housing demand is met would depend on the prices and rents of the new units.

COMMUNITY SERVICES AND INFRASTRUCTURE

The residential population in this variant would increase community services needs above those in Alternative N. Fire incidents and service hours would be about 60% higher than in Alternative N, while good intent and rescue calls would be about 65% higher. Neither Alternative N nor the variant would require an additional engine or truck company.

Police incidents would be about 50% higher than in Alternative N. Due to the addition of residential uses, the nature of crimes in the Project Area would include more assaults and domestic violence. While about nine more patrol officers would be needed to maintain existing service levels in Alternative N at build-out (see Table VI.D.5, p. VI.D.44), about 12 more would be needed with this variant. Investigative and other personnel requirements would be the same as for Alternative N.

There would be no impact on the San Francisco Unified School District (SFUSD) in Alternative N (see p. VI.D.54). Under this variant, however, if the composition of the residential population were similar to that in Alternatives A and B, it would include about 225 public school students (95 in grades kindergarten-5; 55 in grades 6-8; and 75 in grades 9-12). About four elementary, two middle and three high school classrooms would be required and about 14 teachers would be needed. As with Alternatives A and B, by the year 2000 existing schools would not have sufficient space to accommodate any of the Project Area students under this variant of Alternative N.

The residents in this variant would require about ten acres of parkland; this need would not be met by the 5.2 acres to be provided along the channel (see Figure VI.D.8, p. VI.D.64). This variant also would not fully serve recreation needs because it would not provide recreation buildings or active recreation areas suitable for field and court sports.

Demand for library services would increase, but residents would use the Potrero Branch, Main Branch or other San Francisco branch libraries (see p. VI.D.93). City responses to ambulance calls would be about 140 calls per year more than in Alternative N (see Table VI.D.21, p. VI.D.99). Those calls and other DPH services would be handled by existing department resources (see Public Health, p. VI.D.100). Water demand and sewage generation would be about 25% higher than in Alternative N, but would be accommodated within the capacities of existing systems (see Water Supply, p. VI.D.103, and Sewers and Wastewater Treatment, p. VI.D.107). Solid waste generated would be about 23% greater than under Alternative N; that would still represent about 2% of total San Francisco solid waste generation (see p. VI.D.111). Effects on streets would not differ from those discussed for Alternative N (see p. VI.D.114).

TRANSPORTATION

The addition of 1,000 residential units (adding about 1,975 residents) would increase travel demand originating in the Project Area under Alternative N by about 5%. At build-out, about 5,700 more daily vehicle trips would be generated than with Alternative N. The 40 housing-related jobs that would be created would increase travel demand attracted to Mission Bay very slightly. The effect of the total increase on projected cumulative highway vehicle volumes and transit riders would be statistically insignificant (about 5% more total trips and 4% more peak-hour trips than Alternative N). The inclusion of additional housing within the Project Area, however, would have the beneficial effect of increasing commute trips that remain within the Downtown & Vicinity, thus decreasing commute trips that would cross MUNI or regional screenlines.

Cumulative transportation analysis of Alternative A, B, and N showed that there are few substantial differences in impacts among the Alternatives./2/ The numerical differences in travel demand among Alternatives A, B, and N are greater than those between Alternative N and this variant. Therefore, transportation impacts under this variant would not be statistically different. Significant cumulative transportation impacts, identified under Alternatives A, B, and N, however, would continue to occur under this variant.

AIR QUALITY

Additional motor vehicle trips would result in a net increase in vehicular emissions for the Project Area that would be about 6% greater than that estimated for Alternative N (see Table VI.F.3, p. VI.F.14). The difference between this variant and Alternative N would not be significant with respect to potential local and regional air quality effects. That is, no excesses of CO standards would occur within the Project Area, but emissions would be significant on a County-wide basis. For this variant, total vehicular emissions would be about 80% of the emissions estimated to occur under Alternative A and about 120% of those under Alternative B. Like Alternative N, this variant would not be entirely consistent with the goals and recommendations of the Air Quality Plan, but by including residential development near an employment center, this variant would reduce the vehicle miles traveled for commuting by these future residents, which is one of the long-term goals of the Plan. However, this variant would also allow for more intensive development of the Project Area than would occur under Alternative N which already exceeded projections assumed for demonstration of attainment in the Plan.

NOISE

Increased evening rush-hour motor-vehicle traffic in this variant would increase traffic noise levels above those estimated for Alternative N (see p. VI.G.23). An increase of about 4% over Project Area peak-hour traffic volumes for Alternative N would be produced by this variant. If the percentage increase were to affect all Project Area streets, the largest increase in automobile traffic would be along I-280 where about 270 more automobiles would travel. Traffic volume increases of 4% would increase noise levels by less than one dBA, L_{eq}, over Alternative N levels, which would not be a noticeable difference. The addition of housing would introduce new noise-sensitive land uses into an industrial area with potentially high noise levels from truck traffic (see p. VI.G.23) and industrial/commercial processes (see p. VI.G.27). Compared to other locations within the Project Area, the lowest traffic noise levels would occur south of the channel between Fourth and Sixth Streets (see p. VI.G.24), the area proposed for the housing in this variant. Industrial / commercial process noise could be generated by businesses anywhere in the surrounding M-2 Industrial space, resulting in increases in intrusive noise in the housing area. Exterior noise levels at the housing development could reach 64 dBA, L_{eq}. Pursuant to Title 24 noise insulation standards, acoustical analyses would be required prior to construction of the housing to demonstrate that interior noise levels would be less than 45 dBA, CNEL (see p. VI.G.28).

ENERGY

Total annual operational energy consumption would increase by about 7% above the levels estimated for Alternative N (see Table VI.H.2, p. VI.H.13). Electricity consumption would be about 3% higher and natural gas consumption would be about 26% higher. As with the EIR Alternatives, Project Area energy consumption would add incrementally to PG&E's total system load, but would have little effect on PG&E's capacity (see p. VI.H.15). Construction energy would be about 7% more than that estimated for Alternative N. Transportation energy consumption would be about 5% higher (see p. VI.H.8 and p. VI.H.19).

ARCHITECTURAL RESOURCES AND URBAN DESIGN

In Alternative N west of Third Street, new M-2 Industrial buildings would be expected to vary in height from one to four stories, with heights generally up to 40 feet. Buildings of that height would be up to as high as the 40-foot line on Figure VI.I.5, pp. VI.I.28-VI.I.29, and would not obscure views from Potrero Hill of the Bay. The MDR units south of the channel west of Third Street in this variant would be about 20 feet higher than the M-2 uses in Alternative N. Therefore, they could obscure views from Potrero Hill of the Third and Fourth Street bridges, China Basin Channel, and part of the China Basin Building. However, they would not obscure views of downtown, the Bay Bridge, or East Bay shoreline.

In general, the residential buildings would provide more diversity of building design in the area south of the channel between Fourth and Sixth Streets than would occur in Alternative N. The street-level character of the blocks along Channel, Hooper, Irwin, Fourth and Sixth Streets would be one of a medium-density residential neighborhood in this variant instead of an industrial area as under Alternative N. For example, the view of China Basin Channel near Fourth Street would differ from that in Alternative N (see Figure VI.I.8, pp. VI.I.46-VI.I.47) because four-to six-story housing would abut the south side of the channel in this variant instead of the two-story M-2 Industrial uses in Alternative N. The scale of MDR would be similar to that shown in Figure VI.I.10, pp. VI.I.52-VI.I.53, for Alternative A (Viewpoint 5). As with Alternative N, MDR buildings in this variant would shade open space south of China Basin Channel in mornings and at mid-day.

GEOLOGY AND SEISMICITY

Geology and Seismicity impacts would be similar to those assessed for Alternative N (see pp. VI.K.23-VI.K.32), except that the approximately 1,975 additional Project Area residents in this variant would represent an increase in the size of the Project Area population that could be affected in the event of a major nighttime earthquake (see p. VI.K.43). All buildings over five stories in height would require pile-supported foundations.

HAZARDOUS WASTES

Housing proposed in this variant could expose additional residents to potential hazards from site clean-up activities or undetected contamination. As with Alternative N, site investigations and hazardous materials clean-up would occur on a parcel-by-parcel basis as developments are proposed (see VI.N. Hazardous Wastes, p. VI.N.27). There would be no overall mitigation program as there would for Alternatives A and B, which embody integrated development plans.

GROWTH INDUCEMENT

The development of housing in the Project Area under this variant would result in more total housing and population in San Francisco than expected under Alternative N. There also might be somewhat less infill housing development in other parts of the City than expected under Alternative N which has no housing in the Project Area. In particular, this variant could result in somewhat less housing demand in nearby residential areas than would be expected with Alternative N. Other aspects of growth inducement for this variant would be the same as those described for Alternative N on pp. VI.O.1-VI.O.9.

OTHER TOPICS

Other environmental effects of this variant not discussed above would be essentially the same as those in Alternative N (see VI.J. Cultural Resources, p. VI.J.21; VI.L. Hydrology and Water Quality, pp. VI.L.14, VI.L.18, VI.L.22, VI.L.29; and VI.M. Vegetation and Wildlife, p. VI.M.13).

MITIGATION

The same mitigation measures would apply to this variant as would apply to Alternatives A and B for housing-related issues and Alternative N for other uses (see Mitigation sections in Chapter VI.). As discussed above, the housing in this variant could enable the developer of the office blocks to satisfy the City's OAHPP requirement on-site. In addition to Alternative N and housing-related mitigation measures, the following would apply:

- The SFUSD could expand existing schools (e.g., by using temporary classrooms) to accommodate the approximately 225 Project Area public school students generated by this variant.

- To meet the recreation needs of Project Area residents, about five more acres of open space and active open space areas and facilities could be provided in addition to passive open space along the channel.

- Pursuant to Title 24 noise insulation standards, acoustical analyses would be required prior to construction of housing to demonstrate that interior noise levels would be less than 45 dBA, CNEL.

2. PORT-PRIORITY RETENTION (ALTERNATIVE B)

This variant of Alternative B would replace Alternative B housing, open space, wetlands and S/LI/RD uses east of Third Street with Port-Related/M-2 uses (see Figure VII.2). Such Port-Related uses are called for under a variety of public plans, as discussed below. Those Port-Related/M-2 uses would be similar to the uses projected for east of Third Street under Alternative N and would be consistent with Central Waterfront Plan, BCDC and Port designation of the area for Port Priority Use. As under Alternative N, about one million square feet of building space and 1.8 million square feet of land would be used for Port-Related/M-2 activities east of Third Street.

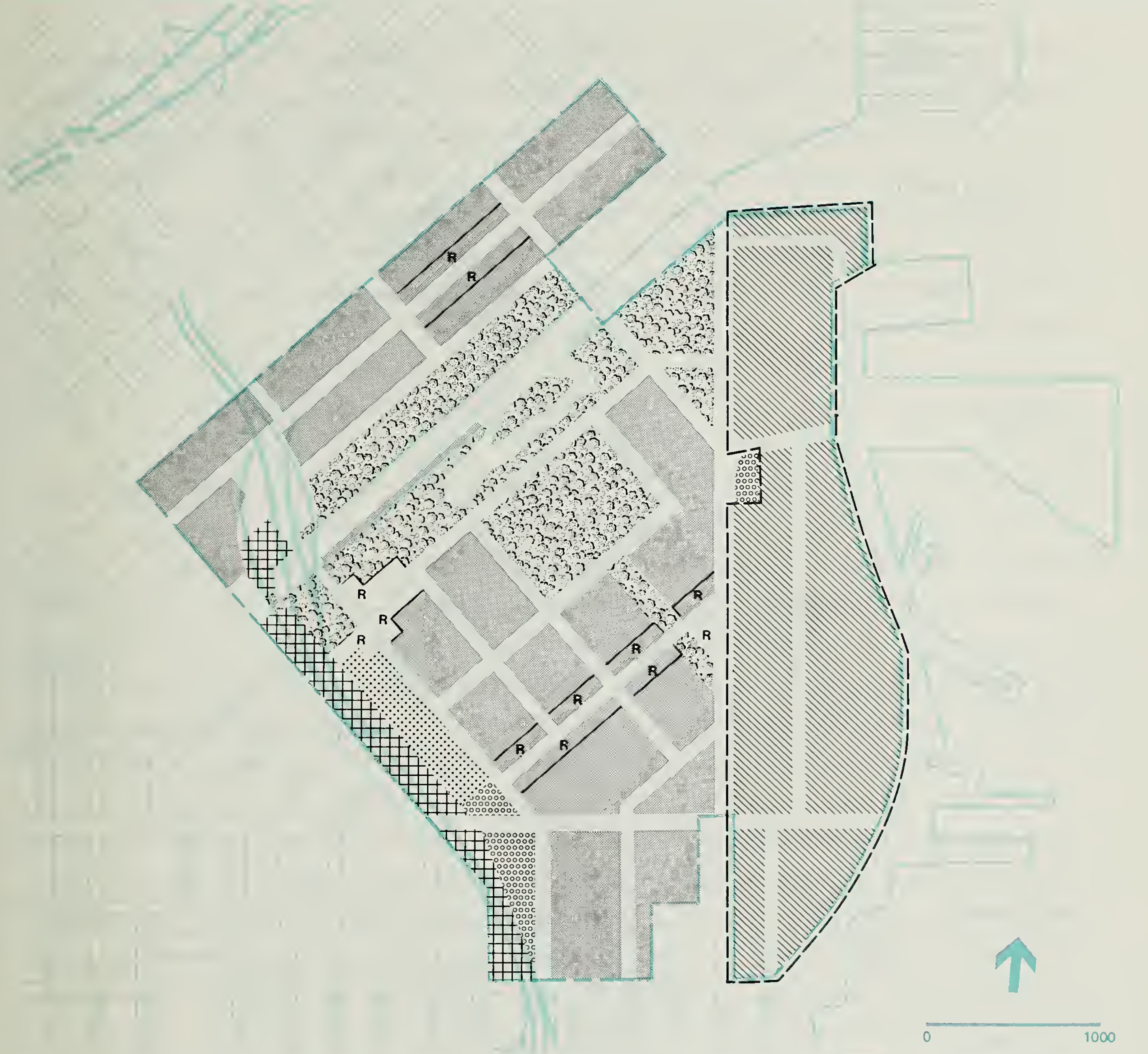
To accommodate Port-Related uses, this variant would eliminate the following Alternative B uses east of Third Street:

- 2,320 units of MDR, reducing the total number of units to 7,680, and reducing total residential population at build-out by about 4,410 persons, from 18,670 to 14,260. Housing-related employment would be about 90 employees less than under Alternative B;
- 20.6 acres of wetlands (the 13.6-acre wetlands at China Basin and the 7.0-acre wetlands between Piers 54 and 64);
- 9.1 acres of parkland, and 2.5 acres of publicly accessible open space associated with the removed housing and S/LI/RD uses;
- 420,000 square feet of S/LI/RD space (all in Alternative B), reducing employment by 900 employees; and
- 1.8 acres of community facilities, reducing employment by about 120 employees. (The 0.8-acre Fire Station 30 site would be retained.)

Compared to Alternative B, total employment for this variant would be increased by about 1,145 Port-Related/M-2 employees and decreased by about 1,120 housing-related, S/LI/RD, parks, open space, and community facilities employees. The net result would be an increase of about 25 employees.

PUBLIC PLANS, POLICIES, AND PERMITS

Alternatives A and B would not respond to the Central Waterfront Plan's overall objective to expand maritime and industrial activity east of Third Street (see p. VI.A.34), the Seaport Plan's designation of Piers 52 to 64 as a near-term container terminal site and the area east of Third Street as a Port Priority Use area (see pp. VI.A.55-VI.A.56), or BCDC Bay Plan and San Francisco Waterfront Special Area Plan designation of the area east of Third Street as Port Priority Use (see pp. VI.A.58-VI.A.59). By comparison, this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AREA DIFFERENT FROM ALTERNATIVE B
OFFICE
R RETAIL
R RETAIL (Ground Floor) WITH OTHER USE
▨ PORT-RELATED / M-2
HOUSING
COMMUNITY FACILITIES
OPEN SPACE (Parkland, Wetlands)
RAIL AND EXISTING PUMP STATION

Mission Bay

FIGURE VII.2
PORT-PRIORITY RETENTION (ALTERNATIVE B)

SOURCE: Environmental Science Associates, Inc.

variant would respond to those plans and policies by reserving the Project Area east of Third Street for Port Priority uses. That reserved area would provide the backland needed to potentially develop a container terminal at Mission Rock / Pier 50 in the longer-term future. A land exchange to acquire property for transfer of the near-term container terminal development site designation from Piers 52 to 64 to Piers 70 to 80 (see IV. Study Approach and Organization, p. IV.2) would not be necessary. Amendments to the above-referenced plans that would be required for Alternatives A and B would not be needed in this variant.

LAND USE, BUSINESS ACTIVITY, AND EMPLOYMENT

As noted above under Public Plans, Policies and Permits, this variant would reserve the area east of Third Street as a "Port-Priority" area that could accommodate businesses similar to the existing maritime-related businesses. Thus, there would be less transition in that area than otherwise would occur in Alternative B.

The number and types of jobs in the Port-Related/M-2 space would be similar to those estimated for that use in Alternative N (see Table V.6, p. V.35). While this variant would result in about 1,145 Port-Related/M-2 jobs, these jobs would take the place of about 900 S/LI/RD, 90 housing-related and 125 community facilities and open space jobs estimated for Alternative B east of Third Street. There would be about 25 more jobs than under Alternative B (a difference of less than 1%). With this variant, there would be more crafts, operatives, and other jobs in the Project Area, and fewer professional, technical, managerial, and clerical jobs than there would be in Alternative B without port-priority retention east of Third Street.

Alternative B would preclude future container terminal development at Mission Rock/Pier 50 because non-maritime uses would occupy the land that would be necessary as backland for such a terminal (see p. VI.B.102). By comparison, this variant would reserve the entire area east of Third Street for potential container terminal development in the longer term future (beyond the time horizon for build-out in the EIR). The effects on maritime-related uses in the Project Area of reserving that land would be similar to those discussed for Alternative N (see p. VI.B.103). Effects on the piers adjacent to Mission Bay also would differ from those in Alternative B. In Alternative B, development of residential uses could result in potential land use conflicts and incompatibility with maritime activity on adjacent piers. Eventually the level of maritime activity on the piers could decline (see p. VI.B.117). In this variant, those land use conflicts and compatibility issues would not exist and maritime-related activity could continue on the piers adjacent to Mission Bay. As in Alternative N, the level of maritime activity on those piers would remain low unless the area were developed as a container terminal (see Alternative N discussion on p. VI.B.117).

This variant could pose land use compatibility problems (such as noise) between industrial uses east of Third Street and residential uses on the west side of Third Street. Over the long-term future when the residential neighborhood is established, it could be extremely difficult to develop a container terminal across the street. An active terminal could pose greater land use conflicts than the smaller-scale maritime-related and industrial activity otherwise in this area under this variant.

HOUSING AND POPULATION

This variant would reduce Alternative B's contribution to the City's housing supply by 2,320 housing units (about 23% fewer) to 7,680 units, similar to the total number of units in Alternative A. Compared with Alternative B, this variant would have about 4,410 fewer people living in Mission Bay. However, the characteristics of the remaining Mission Bay population would be the same as those described for Alternative B (see p. VI.C.64). The number of residents would be about 160 less than in Alternative A.

- There would be about 700 fewer affordable units than in Alternative B; the remaining total units (7,680) and affordable units (about 2,300, or 30% of the total) would more than satisfy the number of units required for Alternative B under the City's OAHPP (see Table VI.C.17, p. VI.C.71). However, without changes in the prices of the new housing, units still would not meet the 1990 OAHPP affordability requirements. Considering all employment growth in this variant, the 7,680 housing units built in the Project Area would still exceed by a large amount the number of units needed to accommodate additional San Francisco households with Project Area workers (as would be the case under Alternative B; see Table VI.C.18, p. VI.C.72). The estimated number of units to accommodate such households under this variant (about 725) would represent about 9% of the new housing units to be built in the Project Area. The remainder (about 6,950) would represent housing available to accommodate other demand besides that associated with Project Area employment growth, about 25% less than the amount of such housing in Alternative B.

COMMUNITY SERVICES AND INFRASTRUCTURE

The Port-Related uses would reduce the demand for most community services below levels in Alternative B. The variant would have about 25% fewer fire incidents per year.

The proportion of good intent and rescue calls, which require less time per call than do other types of incidents, would be lower and service hours would therefore be about 20% lower. Thus, while Alternative B at build-out would require a truck company in addition to an engine company needed by the year 2000 (see p. VI.D.41), that truck company would not be required in this variant.

Police incidents would be about 25% lower than in Alternative B and the nature of crimes would shift to proportionally more theft and fewer assaults and incidents of domestic violence. About 65 instead of 90 additional patrol and other police personnel would be required at build-out to maintain current levels of service (see Table V.D.5, p. VI.D.44).

The Project Area population in this variant would include about 500 (27%) fewer public school students in grades kindergarten through 12 than the approximately 1,870 estimated in Alternative B (see Table VI.D.9, p. VI.D.57). The variant would require about 50 classrooms and 115 teachers, about 18 fewer classrooms and 30 fewer teachers (see Table VI.D.10, p. VI.D.58). Student population and need for classrooms and teachers would be about the same as for Alternative A.

Replacing 9.1 acres of parkland, 20.6 acres of wetlands, and 2.5 acres of open space associated with other uses would reduce total open space in Alternative B by about 32% from 99.4 acres to 67.2 total acres of open space. The remaining 52 acres of parks and wetlands would not satisfy the 14,260 residents' demand for about 72 acres of neighborhood and district open space, similar to the open space requirements for residents for Alternative A. Open space and recreation personnel requirements associated with parkland would be about 20% lower than in Alternative B (see Table VI.D.17, p. VI.D.80).

The 13.6-acre wetlands at China Basin (OS-7) and 7-acre wetlands between Piers 54 and 64 (OS-11) in Alternative B would provide a visual, educational and recreation resource for Project Area residents and employees, other residents of the City and visitors from outside San Francisco (see p. VI.D.85). Although the 13.2-acre mid-channel wetlands (OS-2) would remain in this variant, forgoing development of those two wetlands would reduce the regional attractiveness of the area to wetlands visitors. The reduction in total open space in this variant also would reduce Alternative B open space benefits to Nearby Areas (see p. VI.D.85).

Demand for library services would be lower than in Alternative B (see p. VI.D.93). City responses to ambulance calls would be about 1,000 calls per year, or about 10% fewer than in Alternative B. That number of calls would represent about one-third of a full-time paramedic's time (see Table VI.D.21, p. VI.D.99). This service demand would be similar to that for Alternative A. Water demand and sewage generation would be about 20% lower than in Alternative B and about 35% less than Alternative A (see Water Supply, Table VI.D.22, p. VI.D.101, and Sewers and Wastewater Treatment, Table VI.D.23, p. VI.D.104). About 18% less solid waste would be generated than in Alternative B (see Table VI.D.24, p. VI.D.109). As in Alternative N, Port-Priority/M-2 uses east of Third Street would generate more truck traffic than in Alternative B. That may generate greater maintenance requirements for off-site streets (see p. VI.D.114).

TRANSPORTATION

This variant would have 4,410 fewer residents than would Alternative B, resulting in a 23% lower travel demand originating in the Project Area than Alternative B. The increase of about 25 employees projected by the trade-off between Port-Related/M-2 jobs and jobs associated with S/LI/RD, housing, open space and community facilities would generate a 0.5% increase in peak travel demand attracted to Mission Bay.

The net change in total travel demand generated by this variant would be about 18% below that forecast for Alternative B. This decrease would not significantly change projections of either cumulative screenline travel demand or intersection levels of service. The reduction in number of housing units within the Project Area, however, would decrease opportunities for downtown employees to live in the Downtown & Vicinity, thus increasing commute trips that would cross MUNI or regional screenlines.

Cumulative transportation analysis of Alternatives A, B, and N showed that there are few substantial differences in impact among the Alternatives./2/ The numerical differences in travel demand among Alternatives A, B, and N are greater than those between Alternative B and this variant. Therefore, the transportation impacts under this variant would not be statistically different. However, significant cumulative transportation impacts projected under Alternatives A, B and N would also occur under this variant.

AIR QUALITY

Motor vehicle trips generated by this variant would result in a 25% smaller net increase in vehicular emissions for the Project Area than that estimated for Alternative B (see Table VI.F.3, p. VI.F.14). Unlike Alternative B, HC emissions under this variant would not be significant on the basis of the BAAQMD's 1% significance threshold. However, emissions of CO and NO_x would still be significant. Like Alternative B, no excesses of curbside CO standards would occur within the Project Area. For this variant, total vehicular emissions would be about one-half of those under Alternative A and about 70% of those under Alternative N.

Stationary source emissions, considered negligible for Alternative B, would be greater under this variant due to those emissions that would be generated by industrial processes and activities. However, potentially significant industrial emissions would be abated by Best Available Control technology as required through BAAQMD rules and regulations. In all, industrial emissions under this variant would offset the reduction in vehicular emissions but not to such an extent that total Project Area emissions would be greater under this variant than under Alternative B.

With respect to the Air Quality Plan, this variant would allow for development that would be closer to projections used in the Plan to demonstrate attainment than that under Alternative B; it would, however, still exceed these projections.

NOISE

The decrease in peak-hour traffic associated with reducing the residential population in this variant would reduce average traffic noise levels, but probably not by an amount perceptible to the human ear. If the 23% net reduction in total travel demand forecast in Transportation were applied to automobile traffic along Third Street for example, the change in roadside noise levels would be an imperceptible 0.8 dBA, L_{eq} decrease. Similarly, increased truck traffic that would result from adding Port-Priority uses east of Third Street would probably not result in higher traffic noise levels along Third Street than in Alternative B. Although the actual increase in truck traffic that would occur along Third Street is not known, even a 100% increase in trucks, over the volume predicted for Alternative B in 2020, combined with the 23% reduction in automobiles, would not cause a noticeable increase in composite roadside noise levels along Third Street. Traffic noise in that area would be similar to that described for Alternative N (see p. VI.G.23), and could reach 80 dBA, L_{eq}, at residential uses along the west side of Third Street. Noise impacts at these receptors would be imperceptibly higher than for Alternative A or B.

The residential areas along the west side of Third Street could be exposed to some industrial / maritime process noise generated by this variant's Port-Related/M-2 uses on the east side of Third Street. However, traffic noise levels along Third Street itself would be so great (up to 80 dBA, L_{eq}) that industrial noises (estimated to be up to about 65 dBA,

L_{eq}, at this housing) would rarely be audible. In addition, noise insulation, which would be necessary for housing on the west side of Third Street, would also insulate against industrial noise to the east.

ENERGY

- Total annual operational energy consumption would decrease by about 9% from that under Alternative B. That total decrease would be composed of approximately 0.4% and 18% decreases in electricity and natural gas consumption, respectively (see Table VI.H.2, p. VI.H.13). Construction energy consumption would decrease by about 8% from that estimated for Alternative B (see p. VI.H.8). Transportation energy consumption would be lower than under Alternative B (see p. VI.H.19), because total Project Area travel demand would be lower.

ARCHITECTURAL RESOURCES AND URBAN DESIGN

In this variant, views from Potrero Hill of the area east of Third Street would be similar to those described for that area in Alternative N (see p. VI.I.35). Substituting low-rise Port-Priority uses for Alternative B's wetlands, parkland and residential uses east of Third Street would reduce the visual amenities offered by those uses. The area east of Third Street would be developed more incrementally in this variant than it would under a master-planned development in Alternatives A or B, resulting in a less-coherent overall urban design.

GEOLOGY AND SEISMICITY

- Not developing wetlands at China Basin and south of Pier 54 would reduce by about 220,000 cubic yards the amount of material that otherwise would need to be dry dredged and used or disposed of for Alternative B (see Table VI.K.1, p. VI.K.20). Fewer residents would be affected in the event of a major earthquake (see p. VI.K.42). To the extent that the M-2 / Port-Related area east of Third contains vacant land, it could offer potential areas for residents in the Project Area to gather in the event of an evacuation.

HYDROLOGY AND WATER QUALITY

Wetlands in Alternative B could offer some beneficial effects to water quality by trapping sediments and providing oxygen to the water (see p. VI.L.30). Forgoing the wetlands at China Basin and between Piers 54 and 64 in this variant could reduce those beneficial effects. From a hydrologic and water quality perspective, the mid-channel wetlands that would remain in this variant would be the least-viable wetlands location while the China Basin location would be the most-viable. Of the three wetland areas proposed in Alternative B, the mid-channel area would be subject to the worst water quality conditions, because it would have less tidal flushing and be closer to the sewer outfall.

VEGETATION AND WILDLIFE

This variant would forgo the benefits to shorebirds, herons and egrets, wetlands plant species and aquatic life that would be provided by wetlands at China Basin and along the bayfront (see VI.M. Vegetation and Wildlife, p. VI.M.9, and p. VI.M.17). The remaining mid-channel wetlands area would offer the lowest potential vegetation and wildlife benefits of the three wetland locations considered in Alternative B, but would offer some new areas for aquatic life and new plant and bird species in the Project Area compared to current conditions along the channel banks.

HAZARDOUS WASTES

Hazardous waste impacts would be similar to those under Alternative B, although potential impacts from site clean-up activities or undetected contamination would be slightly lower because of the reduction in housing and open space, and because of reduced excavation for wetlands. However, there might be slightly more potential for residents to be exposed to accidental releases of any hazardous materials handled by Port-Related/M-2 businesses.

GROWTH INDUCEMENT

This variant would result in less total housing and population in the City than would Alternative B. Not all of the difference would represent a shift to other parts of the region outside San Francisco, however. Some of the difference between this variant and Alternative B would mean relatively more housing demand and population growth in other parts of the City. There also would be more population growth and associated demand for housing and community services in various other locations throughout the region.

Other aspects of growth inducement would be similar to those for Alternative B, see pp. VI.O.1-VI.O.9, with the exception of land use conflicts between uses east of Third Street in the Project Area and activities on adjacent piers (see discussion under Land Use, Business Activity, and Employment heading on p. VII.12).

OTHER TOPICS

Other environmental effect of this variant not discussed above would be essentially the same as those in Alternative B (see VI.J. Cultural Resources, p. VI.J.20).

MITIGATION

Mitigation measures included for Alternative B (see Mitigation sections in Chapter VI.) would apply to this variant, with the following differences:

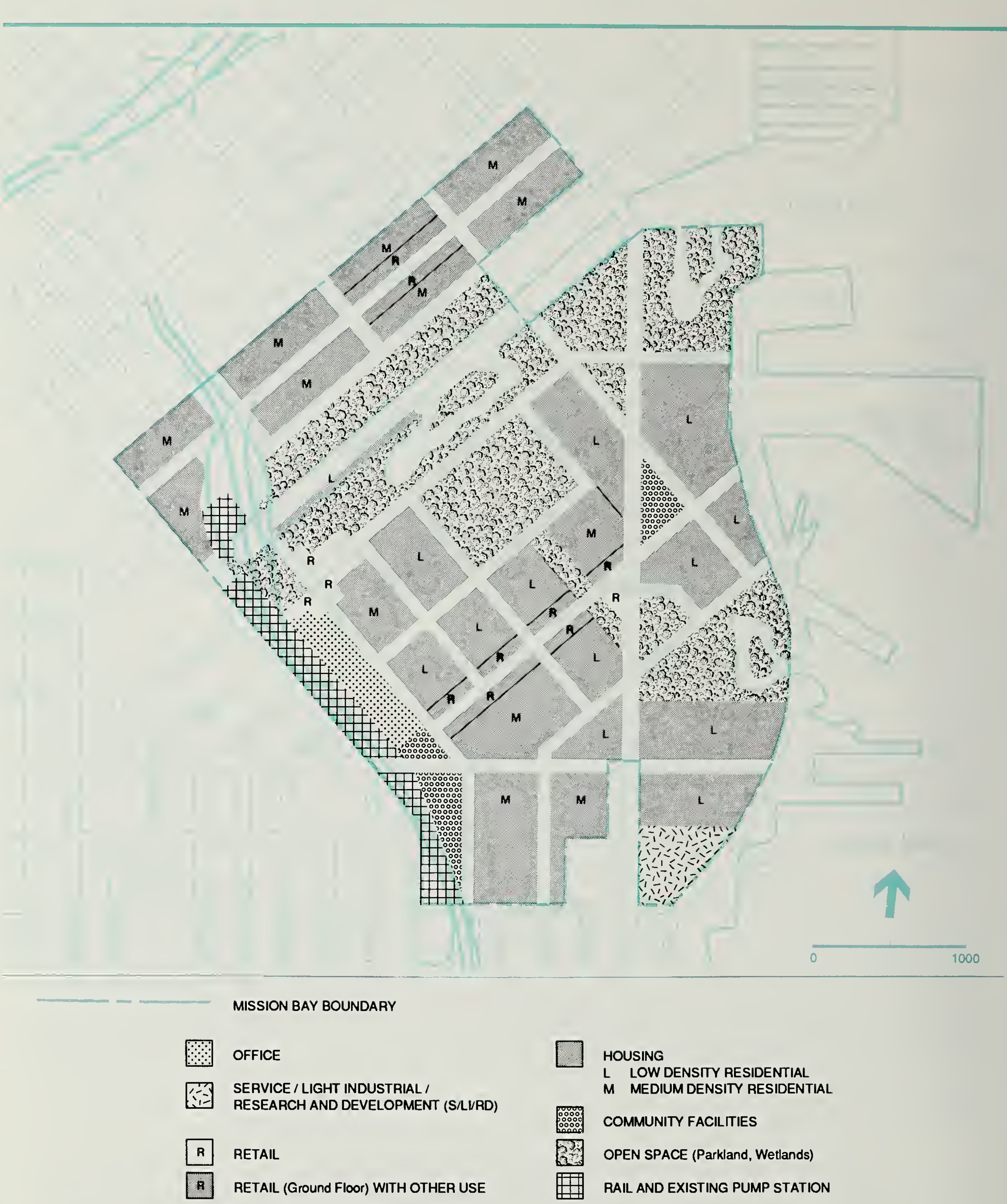
- A fire truck company that would be required in Alternative B (see Mitigation D.2, p. VI.D.115) would not be needed in this variant.
- Mitigation measures for Alternatives A and B to alleviate the exposure of residents along Third Street to vehicular noise would be more important in this variant because of increased truck traffic (see Mitigations G.4 and G.5, p. VI.G.32). In addition, placement of an acoustic wall along the west side of Third Street could reduce noise levels at the housing by up to 10 dBA, and provide an aesthetic screen.

3. REDUCED HOUSING DENSITY (ALTERNATIVE B)

This variant would reduce housing densities throughout the Project Area to 7,700 units, a reduction of 2,300 units from Alternative B (and the same number as in Alternative A). Under this variant, MDR would replace MHDR on the eight blocks north of the channel and one block south of 16th Street. Most of the MDR south of the channel and east of Third Street would be replaced with LDR (see Figure VII.3). That would result in about 1,530 fewer residents, for a total population of about 17,140 residents. Housing-related employment would be about 90 fewer employees than in Alternative B. Commercial, open space and other uses would remain the same. While similar in number of units to Alternative A, this variant would, as with Alternative B, have fewer commercial uses and more open space than would Alternative A.

HOUSING AND POPULATION

Compared with Alternative B, about 23% fewer housing units, including about 690 fewer affordable units, would be built. There would be about 1,530 fewer people living in Mission Bay with this variant. Generally, household characteristics would be similar to those in Alternative B (see p. VI.C.64). Reduced housing density would result in larger average unit sizes and thus relatively more larger households, including households with families and single parents with children. The Mission Bay population could therefore be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MISSION BAY BOUNDARY
OFFICE
SERVICE / LIGHT INDUSTRIAL / RESEARCH AND DEVELOPMENT (S/LI/RD)
R RETAIL
R RETAIL (Ground Floor) WITH OTHER USE
HOUSING
L LOW DENSITY RESIDENTIAL
M MEDIUM DENSITY RESIDENTIAL
COMMUNITY FACILITIES
OPEN SPACE (Parkland, Wetlands)
RAIL AND EXISTING PUMP STATION

Mission Bay

FIGURE VII.3
REDUCED HOUSING DENSITY
(ALTERNATIVE B)

SOURCE: Environmental Science Associates, Inc.

relatively younger. With relatively more larger units, and therefore more persons per household, this variant would have a larger population than Alternative A, although the number of units would be the same.

- The remaining total units (7,700) and affordable units (about 2,310, or 30% of the total units) would satisfy the number of units required for Alternative B under the City's OAHPP (see Table VI.C.17, p. VI.C.71). However, without changes in the prices of the new housing, units still would not meet the 1990 OAHPP affordability requirements. The remaining units would also exceed the housing demand of additional San Francisco households with Project Area workers (see Table VI.C.18, p. VI.C.72). The amount would be very similar to that described above for the port-priority variant (Variant 2) on Alternative B, so the conclusions summarized on p. VII.13 apply here as well.

COMMUNITY SERVICES AND INFRASTRUCTURE

Reducing Alternative B housing densities (and its population) would reduce community services needs. Fire incidents, and thus service hours, would be about 20% lower than in Alternative B. This variant would require a truck company by build-out and an engine company by the year 2000, as for Alternative B (see p. VI.D.41).

Police incidents would be about 20% lower than with Alternative B. However, this variant would require about 90% of the police personnel projected for Alternative B at build-out (see Table VI.D.5, p. VI.D.44), a need for about 85 people. Additional police station space would be needed to house these personnel.

The Project Area population for this variant would include about 175 (9%) fewer public school students in grades K-12 than the approximately 1,870 estimated in Alternative B (see Table VI.D.9, p. VI.D.57). About 62 classrooms and 105 teachers would be required, about six fewer classrooms and 11 fewer teachers than for Alternative B (see Table VI.D.10, p. VI.D.58).

The residential population in this variant would require about 86 acres of open space that would generally be accommodated by the 82 acres provided (not including open space associated with other areas). Demand for library services would be lower than in Alternative B (see p. VI.D.93). City responses to ambulance calls would be about 110 calls per year (8%) less than in Alternative B (see Table VI.D.21, p. VI.D.99). The paramedic and vehicle requirements associated with those calls would be proportionally reduced. Water demand and sewage generation would be about 7% less than in Alternative B (see Water Supply, Table VI.D.22, p. VI.D.101, and Sewers and Wastewater Treatment, Table VI.D.23, p. VI.D.104). Solid waste generation would be about 7% lower than in Alternative B (see Table VI.D.24, p. VI.D.109). Effects on streets would be the same as in Alternative B (see p. VI.D.114).

TRANSPORTATION

The reduction of 1,530 residents would result in 8% lower p.m. peak travel demand entering the Project Area than in Alternative B. The loss of 2,300 residential units would reduce housing-related employment by about 90 jobs. This decrease in employment within the Project Area would result in a 1% decrease in p.m. peak travel demand leaving Mission Bay.

The net change in total travel demand generated by this variant would be about 6% less than that forecast for Alternative B. This decrease would not significantly change projections of either cumulative screenline travel demand or intersection levels of service. The reduction in the number of housing units within the Project Area with this variant would have transportation effects similar to those previously discussed in the Port-Priority Retention Variant (Variant 2), which would fall within the range of impacts analyzed in Alternatives A, B, and N.

AIR QUALITY

Fewer motor vehicle trips would result in a 9% smaller net increase in vehicular emissions for the Project Area than that estimated for Alternative B (see Table VI.F.3, p. VI.F.14). Local and regional effects, however, would be virtually the same. Like Alternative B, no curbside excesses of CO standards would occur within the Project Area, but emissions would be significant on a County-wide basis. For this variant, total emissions would be about 57% of those under Alternative A and about 80% of those under Alternative N. With respect to the Air Quality Plan, this variant would allow for development that would be closer to, although still exceeding, the projections used in the Plan to demonstrate attainment.

ENERGY

Total annual operational energy consumption would be about 16% lower than in Alternative B (see Table VI.H.2, p. VI.H.13). Electricity consumption would be about 11% lower and natural gas consumption would be reduced by about 21%. Construction energy would be about 15% lower. Transportation energy consumption also would be lower than in Alternative B (see Construction Energy, p. VI.H.8, and Transportation Energy, p. VI.H.19).

ARCHITECTURAL RESOURCES AND URBAN DESIGN

The reduced housing density throughout the Project Area in this variant would reduce MHDR (averaging up to 100 feet high) to MDR (averaging up to 70 feet high) and most MDR to LDR (averaging up to about 50 feet high). The lower heights would provide less blockage of views from Potrero Hill than what would occur in Alternative B (see p. VI.I.33). The overall scale of buildings in this variant would be lower and more uniform than Alternative B. Streetscape including seven- to eight-story MHDR buildings in Alternative B north of the channel would be replaced by five- to six-story MDR buildings. West of Third Street five- to six-story MDR would be replaced by three- to four-story LDR. For example, the MDR along the north side of Berry Street would be only as high as six stories with this variant, as opposed to eight-story MHDR in Alternative B, illustrated in Figure VI.I.7, pp. VI.I.42-VI.I.43 and Figure VI.I.8, pp. VI.I.46-VI.I.47. The scale of MDR buildings would be similar to that illustrated in Figure VI.I.10, pp. VI.I.52-VI.I.53 for Alternative A. Alternative B in Figure VI.I.10 depicts LDR units near the central open space south of the channel. That scale of development would characterize most of the west of Third Street area in this variant.

The LDR buildings in this variant would create less shadow on Project Area open space, particularly OS-5, OS-8, and OS-9, that would be adjacent to LDR replacing MDR. Overall shadow characteristics of this variant, however, would not differ substantially from those of Alternative B.

GEOLOGY AND SEISMICITY

Decreased housing density in this variant would provide the potential for allowing more shallow foundations in some areas than those expected in Alternative B (see p. VI.K.32 and Figure VI.K.9, p.VI.K.26). Because the residential population would be smaller in this variant than in Alternative B, fewer people could be affected in the event of a major earthquake (see p. VI.K.42).

GROWTH INDUCEMENT

This variant would contribute less to housing and population growth in the City than would Alternative B. The difference in population would be relatively small, however. Generally, the growth inducement aspects of this variant would be the same as those described for Alternative B (see pp. VI.O.1-VI.O.9).

HAZARDOUS WASTES

Hazardous waste impacts would be similar to those under Alternative B, although potential impacts from site clean-up activities or undetected contamination would be slightly lower because of fewer residents under this variant.

OTHER TOPICS

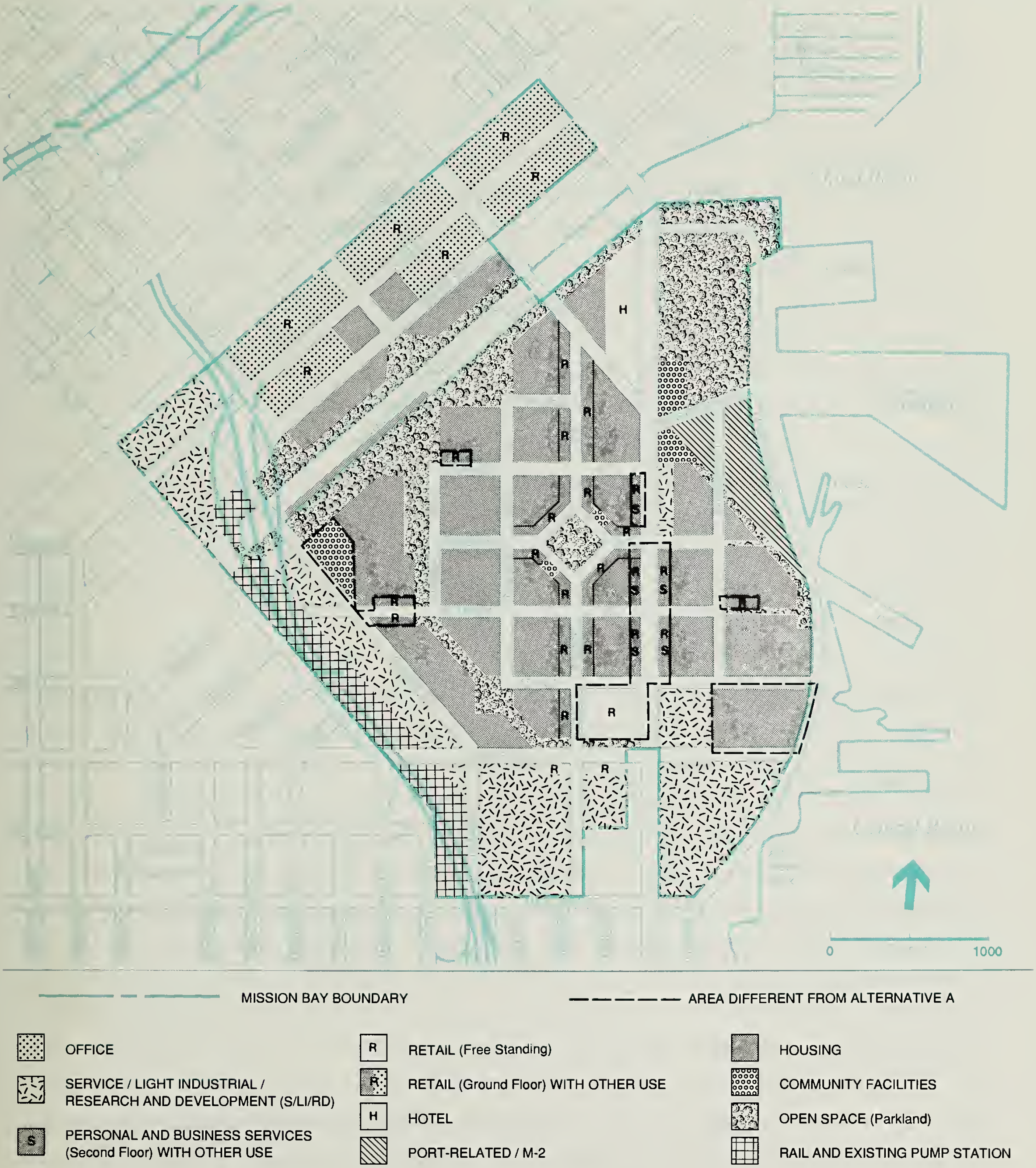
Other environmental effects of this variant would be the same as those in Alternative B (see VI.A. Public Plans, Policies and Permits, starting on p. VI.A.34; VI.B. Land Use, Business Activity and Employment, starting on pp. VI.B.80; VI.G. Noise, pp. VI.G.17, VI.G.23, VI.G.26; VI.J. Cultural Resources, p. VI.J.20; VI.L. Hydrology and Water Quality, pp. VI.L.14, VI.L.18, VI.L.21, VI.L.28, VI.L.30; and VI.M. Vegetation and Wildlife, pp. VI.M.9, VI.M.17).

MITIGATION

Mitigation measures included for Alternative B would apply to this variant. See Mitigation sections in Chapter VI. Environmental Setting, Impact and Mitigation.

4. REPLACEMENT OF SOME S/LI/RD WITH PERSONAL AND BUSINESS SERVICE SPACE AND INCREASED RETAIL AND COMMUNITY FACILITIES (ALTERNATIVE A)

As shown in Figure VII.4, this variant would add about 275,000 square feet of retail-commercial space to Alternative A, reduce S/LI/RD space by 275,000 square feet and add about two acres along Owens Street for a community facilities site suitable for a school. The retail-commercial space would include about 185,000 square feet of ground-floor retail and 90,000 square feet of second-floor personal and business services space. Personal and business service space would include services such as health clubs and hair salons, business services such as photocopy shops and printing shops, and small-scale professional and medical offices. Along Third Street, retail plus personal and business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MISSION BAY BOUNDARY
AREA DIFFERENT FROM ALTERNATIVE A
OFFICE
SERVICE / LIGHT INDUSTRIAL / RESEARCH AND DEVELOPMENT (S/LI/RD)
S PERSONAL AND BUSINESS SERVICES (Second Floor) WITH OTHER USE
R RETAIL (Free Standing)
R RETAIL (Ground Floor) WITH OTHER USE
H HOTEL
PORT-RELATED / M-2
HOUSING
COMMUNITY FACILITIES
OPEN SPACE (Parkland)
RAIL AND EXISTING PUMP STATION

Mission Bay

SOURCE: Environmental Science Associates, Inc.

FIGURE VII.4
REPLACEMENT OF SOME S/LI/RD WITH PERSONAL AND BUSINESS SERVICE SPACE AND INCREASED RETAIL AND COMMUNITY FACILITIES (ALTERNATIVE A)

services space would total about 220,000 square feet in this variant; there would be none along Third Street in Alternative A. Retail space in this variant along Long Bridge Street would total about 205,000 square feet, about 40,000 square feet more than in Alternative A; that addition would be a large-scale retail space suitable for a supermarket with on-site parking, on the block bounded by Long Bridge, Third, 16th and 15th Streets. Retail uses in office north of China Basin Channel would be reduced from about 85,000 square in Alternative A to 40,000 square feet. In addition to the retail locations in Alternative A, a total of about 20,000 square feet of incidental neighborhood support retail would be provided at four residential relocations in the Project Area (at Tiernan and North Iowa Streets, on both sides of Alameda Street near Owens Street, and at Alameda and Michigan Streets).

Analysis of this variant also assumes that the required off-street parking for retail uses would be reduced from the one space per 1,000 square feet of retail floor area that is assumed for Alternatives A and B. In this variant, the required off-street parking assumed for both retail and personal and business services would be one space per 2,500 square feet of floor area.

The MHDR (195-units) that would otherwise have occupied the community facilities site, and the MDR (240) that would otherwise have occupied the large-scale retail site, would be relocated in this variant to the block east of Third Street between 15th and 16th Streets. The 1,330,000 square feet of S/LI/RD space east of Third and south of 15th Street in Alternative A would be reduced by about 275,000 square feet, leaving a total of 3,325,000 square feet of S/LI/RD space in the Project Area. The residential population and number of dwelling units would be the same as in Alternative A (see p. VI.C.39). There would be about 330 more jobs in the Project Area with this variant than in Alternative A.

LAND USE, BUSINESS ACTIVITY, AND EMPLOYMENT

The 330 more jobs would be the net result of adding about 840 retail and personal and business services jobs and 135 community facilities jobs, while subtracting about 645 S/LI/RD jobs. The types of jobs in the Project Area would be different with this variant than with Alternative A. There would be more jobs in sales occupations and fewer in crafts, operatives, and other occupations. The service, professional / technical and managerial jobs would be of the types associated with retail activity, smaller office and service businesses, and a school or other community facility, as opposed to the types associated with the larger companies likely to occupy S/LI/RD development.

The space for personal and business service activities in this variant would offer locations in Mission Bay for small office and other service businesses that would not be accommodated in Alternative A in either the large-scale office development north of the channel or S/LI/RD development; space for such business would also not be available in Alternative B. The personal and business service uses would add to the mix of business activity and diversity of business opportunities in the Project Area.

More of the retail spending of Project Area residents and workers would be captured in Mission Bay with this variant compared to Alternative A. With a supermarket in the Project Area, residents would have a more convenient option for grocery shopping than they would in Alternative A, and would be expected to do most of their convenience shopping there. Some people who worked in the Project Area but lived elsewhere also would do their convenience shopping in Mission Bay. Residents of nearby neighborhoods would partronize the Mission Bay supermarket. With this variant, it is unlikely that a supermarket or neighborhood center would be developed elsewhere in the vicinity outside Mission Bay (e.g., in the South of Market area).

Other Mission Bay retail space in this variant would be supported by Project Area residents and workers as well as by the spending people from outside the Project Area. In Alternative A, a relatively small amount of Mission Bay retail space would depend on spending by people from outside the Project Area. This variant adds a large amount of retail space, in addition to the supermarket, that would depend on that support. To the extent that the additional 145,000 square feet of retail space (not counting the 40,000 square-foot supermarket or the 90,000 square feet of second-floor personal and business service space) were developed as small stores, shops, and restaurants and not as large-scale outlets, the Mission Bay retail space would compete with other neighborhood shopping areas. Compared to Alternative A, there could be somewhat less sales growth in older neighborhood shopping areas on Potrero Hill or in the Mission District, for example. The special character associated with those established neighborhood shopping areas would continue to attract area residents and others, including future Mission Bay residents, people from other parts of the City and other visitors, however. The large amount of new retail development proposed in this variant might have more effect on the potential for other new retail in the vicinity (e.g., South Beach, Yerba Buena Gardens, Showplace Square and other South of Market locations), since Mission Bay retail would offer similar types of stores and restaurants and would be competing with those other developments for spending from that broader market consisting of workers, residents, and visitors in the Downtown & Vicinity.

COMMUNITY SERVICES AND INFRASTRUCTURE

The two-acre community facilities site at Owens and Alameda Streets could be used for a school. Because of the proximity to open space areas, a 450-student elementary, 850-student middle, or 600-student small alternative high school could be accommodated on the two-acre site. Alternatively, the community facilities site could be used for police, fire or other facilities. Need for open space in this variant would be slightly higher than in Alternative A because of the somewhat larger Project Area employment, as well as increased use of open space areas by retail shoppers (see p. VI.D.83). Water use, and thus wastewater generation, would be slightly lower than in Alternative A in this variant because retail uses demand less water than S/LI/RD uses that otherwise would be included in Alternative A. A few more public health inspectors than in Alternative A may be needed to inspect the additional eating and drinking establishments that could occupy the retail space. Fire protection, police protection, ambulance services, libraries, and solid waste generation would be about the same as in Alternative A (see starting on pp. VI.D.32).

TRANSPORTATION

The increase of about 330 employees projected by the trade-off between retail and community facilities jobs and jobs associated with S/LI/RD would generate about a 1% increase in p.m. peak travel demand leaving Mission Bay. The residential population of the Project Area would remain unchanged. The net change in total travel demand generated by this variant would be an increase of less than 1% above that forecast for Alternative A. That increase would not significantly change projections of either cumulative screenline travel demand or intersection levels of service.

Off-peak travel demand associated with personal and business services and retail uses would increase under this variant. Vehicular congestion, however, would not be expected to increase because the location of these chiefly local-serving uses within the residential corridors on Third and Long Bridge Streets, would encourage pedestrian and transit travel modes. The large-scale retail (suitable for a supermarket) at Third and 16th Streets could attract off-peak trips from a greater distance. The p.m. peak-hour vehicle trips attracted by this large-scale retail use would chiefly be local trips within the Project Area and passersby (people already on Third Street for another purpose). The change in p.m. peak-hour traffic through local intersections would not be noticeable, and off-peak traffic would be noticeably less than during the p.m. peak period.

Under this variant, the off-street parking supply rate for retail and personal and business services uses would be reduced from one space per 1,000 square feet to one space per 2,500 square feet of floor area. That reduction in parking supply, together with an increase in parking demand associated with the additional retail and personal and business services space (which have a higher parking demand rate than the correspondingly decreased S/LI/RD space), would result in a net increase of about 480 spaces in the 990-space parking deficit projected for Alternative A at full build-out. The impact of excess parking demand on areas adjacent to the Project Area to the west and south, identified in Alternative A, would worsen as would the impact of overflow retail-generated parking on residential areas within the Project Area.

Mitigation measures to reduce parking impacts for Alternative A (described in VI.E. Transportation, pp. VI.E.207-VI.E.209, and pp. VI.E.222-VI.E.223), would apply to this variant as well.

AIR QUALITY

Daily vehicle trips and corresponding vehicle emissions under this variant would be about the same as for Alternative A. Since pollutant emissions under this variant would be virtually the same as those under Alternative A, the local and regional effects would also be the same. That is, no excesses of curbside CO standards would occur within the Project Area (including at the school site), but emissions would be significant on a county-wide basis. This variant would be more consistent than Alternative A with the Air Quality Plan in that it includes more neighborhood retail uses and community facilities which would encourage pedestrian and public transit modes of travel. However, like Alternative A, this variant would be inconsistent with the Air Quality Plan in that it allows for more intensive development of the Project Area than was assumed for the Plan.

NOISE

This variant would introduce a school (or other community facilities) into an area identified in the Noise Impacts Analysis as being incompatible with such land uses. Existing and future (2020) 24-hour noise levels near Owens Street would exceed 65 dBA, L_{dn}, a level established by the Land Use Compatibility Chart for Community Noise (see Figure VI.G.1, p. VI.G.4) as being incompatible with construction or development of schools. Future peak-hour outdoor noise levels would reach 70 dBA, L_{eq}, which would inhibit enjoyment of outdoor activities. These high outdoor noise levels would be produced by traffic on the I-280 overpass about 100 feet to the west, and by locomotives at the relocated CalTrain station about 300 feet to the southwest. Noise from the latter source would be partially attenuated by S/LI/RD development planned for Owens Street. Compatibility could be achieved through inclusion of noise insulation features in the design of the school. Those features would be identified through a detailed analysis of the noise reduction requirements. As is true for all housing in any location in Mission Bay, housing planned to replace S/LI/RD between 15th and 16th Streets east of Third Street would be located where noise levels are estimated to exceed the Land Use Compatibility guidelines for that land use. However, traffic noise impacts on that housing generated from Third Street would be partially attenuated by intervening buildings containing S/LI/RD activities. Special noise insulation features would need to be included in the design of the housing.

A 1% increase in the peak-hour vehicle traffic identified for Alternative A, would be produced by this variant (see Transportation). If the 1% increase affected all Project Area streets, then the largest automobile increase would occur along I-280, and the largest truck increase would occur along Third Street. The increases in traffic volume would be about 70 automobiles and seven trucks, respectively, which would have no noticeable effect on Project Area or roadside noise levels.

Construction noise impacts for this variant would be the same as those for Alternative A at build-out, as described on p. VI.G.12. The addition of retail space would have no effect on Project Area or roadside noise levels.

Replacement of ground and second-floor housing along Third Street with retail space would eliminate the most noise-sensitive receptors from those locations, thereby reducing noise impacts along this busy corridor. Although less sensitive to noise than housing, the retail uses also would be incompatible with noise levels at these locations without some noise insulation.

ENERGY

Total annual operation energy consumption would be about the same as under Alternative A (see Table VI.H.2, p. VI.H.13). Electricity and natural gas consumption would decrease slightly (less than 1%) with the shift of 275,000 square feet of space from S/LI/RD to retail; that decrease could be partially offset by a new school building. Construction and transportation energy consumption would increase by 1% or less.

ARCHITECTURAL RESOURCES AND URBAN DESIGN

The overall urban design and view effects of this variant would be similar to Alternative A. The additional retail uses with this variant would create more street-level variety of activity and design, compared to the all-residential street frontages on Third Street and in other areas in Alternative A.

GROWTH INDUCEMENT

The larger amount of retail space in this variant compared to Alternative A would capture a larger share of Mission Bay resident and worker retail spending and also would accommodate retail activity that otherwise would locate elsewhere in the City. Compared to Alternative A, this variant would result in less spillover effect associated with retail demand in Nearby Areas. That is because the variant provides for a supermarket, resulting in a larger share of Mission Bay residents' retail spending remaining in the Project Area rather than being spread among other neighborhood shopping streets or contributing to support of another supermarket in the vicinity.

Since this variant provides less space in the Project Area for S/LI/RD activities than does Alternative A, there could be somewhat more demand for that type of development outside the Project Area, in nearby industrial/commercial areas or in other parts of the region. Thus, while retail activity would be more concentrated in the Project Area under this variant than it would under Alternative A, S/LI/RD development would be more dispersed.

Other aspects of growth inducement would be the same as those described for Alternative A on pp. VI.O.1-VI.O.9.

OTHER TOPICS

Other environmental effects of this variant would be the same as those in Alternative A (see VI.A. Public Plans, Policies, and Permits, starting on p. VI.A.34; VI.C. Housing and Population, starting on p. VI.C.64; VI.I. Architectural Resources and Urban Design, p. VI.I.24; VI.J. Cultural Resources, p. VI.J.19; VI.K. Geology and Seismicity, pp. VI.K.22, VI.K.31, VI.K.42; VI.L. Hydrology and Water Quality, pp. VI.L.14, VI.L.18, VI.L.21, VI.L.23; VI.M. Vegetation and Wildlife, pp. VI.M.7, VI.M.14; and VI.N. Hazardous Waste, p. VI.N.37).

MITIGATION

Mitigation measures included for Alternative A would apply to this variant. See Mitigation sections in Chapter VI. Environmental Setting, Impact and Mitigation. Two additional noise mitigation measures are recommended:

- Design and development of a school on Owens Street should proceed only after a detailed analysis of noise reduction requirements has been completed; the design should incorporate noise reduction features thus identified.
- Design and development of retail uses along Third Street should also incorporate the results of a detailed analysis of noise reduction requirements.

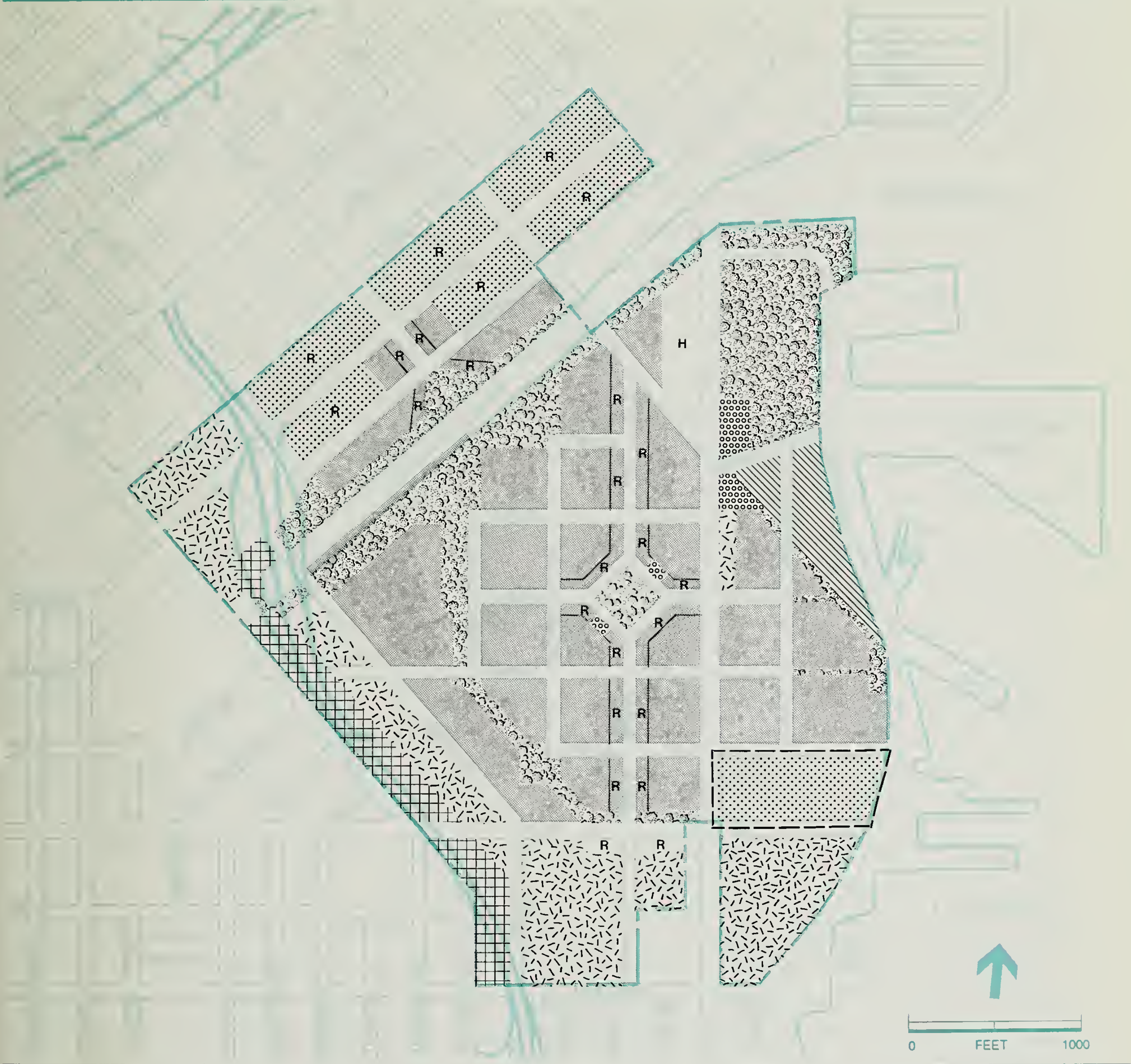
5. REPLACEMENT OF SOME S/LI/RD WITH OFFICE (ALTERNATIVE A)

This variant would replace about 580,000 square feet of S/LI/RD east of Third Street between 15th and 16th Streets in Alternative A with 600,000 square feet of offices (see Figure VII.5). All other uses would be the same as in Alternative A.

LAND USE, BUSINESS ACTIVITY, AND EMPLOYMENT

This variant would introduce office uses south of the channel. The offices would buffer housing proposed north of 15th Street from S/LI/RD light industrial uses. Replacing some S/LI/RD with office would result in about 700 more jobs in the Project Area at build-out, representing about 3% more total employment than Alternative A. This net change would reflect about 2,070 more office jobs and 1,360 fewer S/LI/RD jobs. The differences in the character of office and S/LI/RD activities also would affect the mix of types of jobs in the Project Area. There would be more jobs for clerical and professional / technical workers and fewer jobs for service and craft / operative / other workers.

Most additional employment in the Project Area as a consequence of replacing some S/LI/RD with office would be employment that otherwise would be elsewhere in San Francisco, most likely in other parts of the Downtown & Vicinity, particularly South of Market. Thus, from the cumulative perspective, the activity already is included in the employment growth scenarios analyzed in the EIR. Even if the additional Project Area employment were added to the cumulative scenarios, the amount is not large enough to make a difference in the citywide and regional scenarios or the implications of those scenarios.



——— —— ——— MISSION BAY BOUNDARY

— — — — — AREA DIFFERENT FROM ALTERNATIVE A

▨ OFFICE

▨ SERVICE / LIGHT INDUSTRIAL / RESEARCH AND DEVELOPMENT (S/LI/RD)

R RETAIL

R RETAIL (Ground Floor) WITH OTHER USE

H HOTEL

▧ PORT-RELATED / M-2

▩ HOUSING

○ COMMUNITY FACILITIES

▨ OPEN SPACE (Parkland)

▦ RAIL AND EXISTING PUMP STATION

Mission Bay

FIGURE VII.5
REPLACEMENT OF SOME S/LI/RD WITH OFFICE
(ALTERNATIVE A)

SOURCE: Environmental Science Associates, Inc.

HOUSING AND POPULATION

- More office employment in Mission Bay would mean larger OAHPP requirements. The additional in-lieu fee required for the additional 600,000 square feet of office space would be about $4.16 million. To satisfy the OAHPP requirement with housing development would mean an additional 232 units, 144 to be affordable to moderate- or lower-income households. The number of housing units to be built in the Project Area under Alternative A (7,700) would more than satisfy the total number of units required under the City's OAHPP (1,815 units counting the units associated with the additional office space). The OAHPP affordability requirement would be satisfied if 14.6% of the 7,700 units were ownership units at prices that, on average, are affordable to households of median income and/or rental units at rents that, on average, are affordable to households at 60% of median income.

More total employment in the Project Area would mean more overall housing demand associated with Project Area employment growth. The additional employment (700 jobs) would result in the need for about 110 housing units to accommodate the additional San Francisco households with Project Area workers, including about 85 additional affordable units. With this variant, the number of housing units built (7,700) still would exceed the number of units needed to accommodate Project Area employment growth (about 3,620 units counting those associated with the additional employment). The number of affordable housing units needed would represent about 37% of total units, a higher percentage than the 30% assumed to be priced at affordable levels and a higher percentage than the 36% estimated for Alternative A. Some households with Project Area workers would have incomes below the levels needed to pay the affordable new housing prices assumed for Alternative A. The number of such households would be larger with the additional employment associated with this variant. (The discussion for Alternative A of the implications of these estimates would apply to this variant as well. See pp. VI.C.70-VI.C.75.)

Since the larger amount of employment in the Project Area as a consequence of replacing some S/LI/RD with office would most likely represent a shift of business activity that would otherwise locate elsewhere in the City, there would be no difference in cumulative housing demand with this variant. Consequently, the conclusions about implications for citywide and regional housing market conditions described in VI.C. Housing and Population, pp. VI.C.81-VI.C.86, would still apply.

TRANSPORTATION

The increase of about 700 employees would generate a 3% increase in p.m. peak travel demand leaving Mission Bay. The residential population of the Project Area would remain unchanged. The net change in total travel demand generated by this variant would be an increase of less than 2% above that forecast for Alternative A. This increase would not significantly change projections of either cumulative screenline travel demand or intersection levels of service./2/

AIR QUALITY

Daily vehicle trips and corresponding vehicular emissions under this variant would be about the same as those for Alternative A. Since pollutant emissions under this variant would be virtually the same as under Alternative A, the local and regional effects would also be virtually the same. That is, no excesses of curbside CO standards would occur within the Project Area, but emissions would be significant on a County-wide basis. Like Alternative A, this variant would be consistent with some aspects of the Air Quality Plan and inconsistent with others. This variant would be more inconsistent by allowing for more intensive development of the Project Area than would occur under Alternative A.

NOISE

This variant would replace S/LI/RD space with office space. Office space is identified by the Land Use Compatibility Chart for Community Noise (see Figure VI.G.1, p. VI.G.4) as being slightly more noise sensitive than commercial land use such as S/LI/RD. A noise analysis would be required to identify needed noise insulation features for the office space.

A 3% increase in the peak-hour vehicle traffic identified for Alternative A, would be produced by this variant (see Transportation). If the percentage increase affected all Project Area streets, then the largest automobile increase would occur along I-280, and the largest truck increase would occur along Third Street. The increases in traffic volume would be about 200 automobiles and 20 trucks, respectively. Resulting noise levels would be the same as those identified for Alternative A (see p. VI.G.22). Traffic increases of this magnitude, and less for other Project Area streets, would increase noise levels by less than 1 dBA, L_{eq}, and would have no noticeable effect on Project Area or roadside noise levels.

Construction noise impacts would be the same for this variant as those for Alternative A, as described beginning on p. VI.G.10.

ENERGY

Total annual operational energy consumption would be about the same as under Alternative A (see Table VI.H.2, p. VI.H.13). Electricity and natural gas consumption would increase slightly (by less than 1%) with the additional office space. Construction energy would be about 3% higher; transportation energy could also increase slightly.

ARCHITECTURAL RESOURCES AND URBAN DESIGN

Development of office uses east of Third Street in this variant would be at a density of less than one FAR (ratio of floor area to land area). Thus, building scale would likely be low. Tall buildings, while possible, would not be likely (height limits for office use in the Project Area would be 110 feet, compared to 60-foot height limit assumed for S/LI/RD uses). The variant would retain the overall "bowl" character of building heights similar to Alternative A.

Other urban design effects would be similar to those of Alternative A.

GROWTH INDUCEMENT

This variant would result in somewhat different development patterns for office and S/LI/RD activities than would be expected with Alternative A, as well as a somewhat different set of development pressures for areas outside the Project Area.

By accommodating more office development in the Project Area than would Alternative A, the variant would result in relatively less demand for new office development in other parts of the Downtown & Vicinity. This could mean somewhat lower rents and less development pressure affecting existing space and older businesses. On the other hand, this variant would accommodate fewer S/LI/RD activities in the Project Area than would Alternative A. Some of those activities would look for space South of Market and in other nearby industrial / commercial areas instead. This could put a different source of development pressure on existing space and older businesses. Some of the S/LI/RD development that would not occur in Mission Bay under this variant would occur elsewhere in the region instead.

With the exception of these differences in the types of development in various locations, most of the aspects of growth inducement described for Alternative A on pp. VI.O.1-VI.O.9 apply to this variant as well.

OTHER TOPICS

Other environmental effects of this variant would be the same as those in Alternative A (see VI.A. Public Plans, Policies, and Permits, starting on p. VI.A.34; VI.C. Housing and Population, starting on p. VI.C.64; VI.J. Cultural Resources, p. VI.J.19; VI.K. Geology and Seismicity, pp. VI.K.22, VI.K.31, VI.K.42; VI.L. Hydrology and Water Quality, pp. VI.L.14, VI.L.18, VI.L.21, VI.L.23; VI.M. Vegetation and Wildlife, p. VI.M.7, VI.M.14; and VI.N. Hazardous Wastes, p. VI.N.37).

MITIGATION

Mitigation measures included for Alternative A would apply to this variant (see Mitigation sections in Chapter VI. Environmental Setting, Impact and Mitigation).

6. INCREASED HOUSING HEIGHTS (Alternative B)

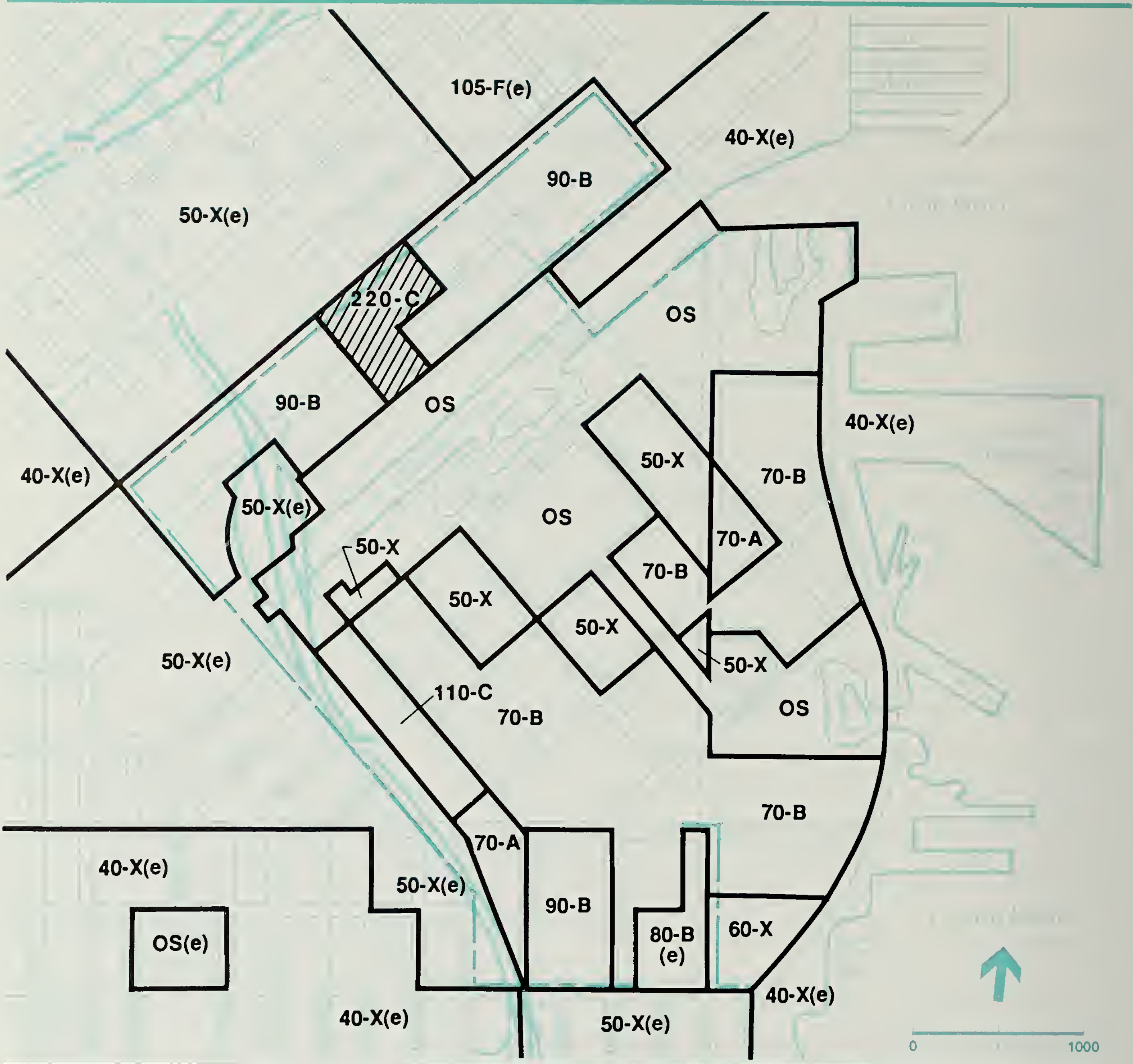
As shown in Figure VII.6, this variant would increase the heights of residential buildings on three corners at Fifth and King Streets north of the channel in Alternative B. Those locations are occupied by MHDR in Alternative B. The buildings in this variant would be up to 220 feet in height, with 20 stories of housing above two stories of retail. Above the fifth floor, there would be about six housing units per floor, while below the fifth floor, each building would have a wider base (podium) that could accommodate more housing units and retail on the first two stories. Although the buildings on these corners would be taller than those in Alternative B, average unit size would be the same as in Alternative B. Thus, the number of dwelling units and residential population in this variant would be the same as in Alternative B (see p. VI.C.66)

COMMUNITY SERVICES AND INFRASTRUCTURE

Community services impacts would be the same as for Alternative B, except that the taller buildings would need to conform to the stricter high-rise requirements of the San Francisco Fire Safety Code. Also, upper stories could be more difficult to reach during a fire or medical emergency than units in lower-rise buildings.

ARCHITECTURAL RESOURCES AND URBAN DESIGN

The 220-foot-high residential buildings of this variant would be about twice as high as the maximum 110-foot-high buildings assumed for Alternative B, and would be more prominent from long-range and street-level viewpoints.


105-F(e)
40-X(e)
90-B
50-X(e)
220-C
OS
90-B
OS
40-X(e)
40-X(e)
50-X
70-B
50-X(e)
OS
70-A
50-X
70-B
50-X
50-X
50-X(e)
50-X
110-C
70-B
OS
70-B
70-A
40-X(e)
50-X(e)
90-B
80-B
(e)
60-X
OS(e)
40-X(e)
40-X(e)
50-X(e)
0
1000

―― ― ―― MISSION BAY BOUNDARY

(e) EXISTING HEIGHT AND BULK DISTRICT

▨ HEIGHT DISTRICT DIFFERS FROM ALTERNATIVE B

NUMBERS INDICATE HEIGHT LIMITS IN FEET. LETTERS INDICATE BULK LIMITS AS FOLLOWS:

Letter	Height above which Maximum Dimensions Apply	Maximum Building Length	Maximum Diagonal Dimension
A	40	110	125
B	50	110	125
C	80	110	125
F	80	110	140
X	Bulk Limits Not Applicable		
OS	See City Planning Code Section 290		

NOTE: The Height and Bulk Districts characterizations indicated in the Project Area reflect districts defined in Article 2.5 of the City Planning Code that would accommodate the uses proposed in the Variant. See Table XIV.A.1.

Mission Bay

SOURCE: Environmental Science Associates, Inc.

FIGURE VII.6
INCREASED HOUSING HEIGHT
(ALTERNATIVE B)

From the Potrero hill viewpoint discussed on p. VI.I.33, the variant would create a prominent high-rise focus north of the channel of three tall buildings that would contrast with the low- to mid-rise scale of Alternative B and the adjacent South of Market neighborhoods (see Figure VII.7). The 220-foot line represents the highest condition that could be seen from that Potrero Hill location, and does not imply that a solid wall of buildings would be constructed to that height in this variant. Because the number of dwelling units would not increase, the height of surrounding residential buildings could be lower, providing more variety in scale and less "benching" north of the channel than in Alternative B.

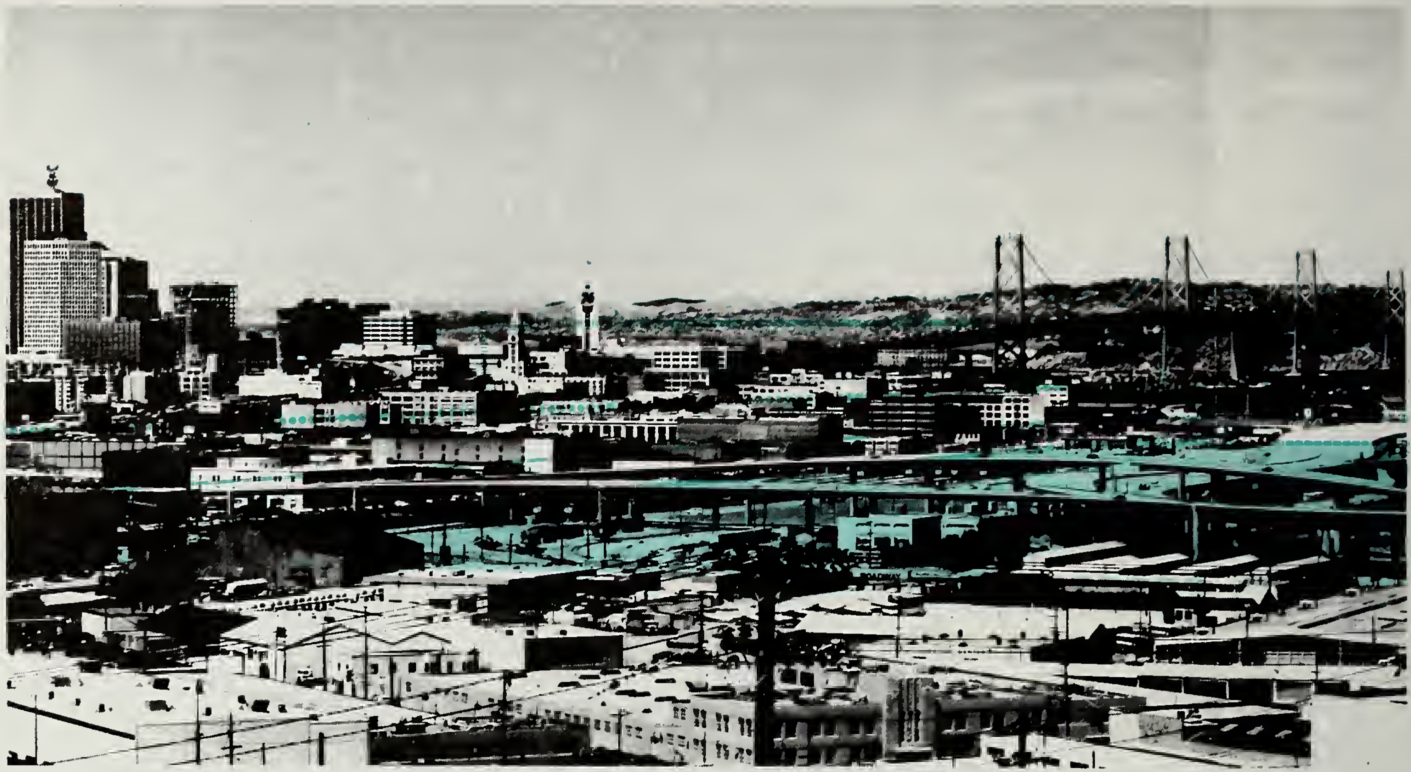
The 22-story residential towers would be visible from street-level areas within Mission Bay. Looking northwesterly from Fourth Street near the channel, the towers would be seen above mid-rise MHDR structures north of the channel. The high-rise towers would obscure distant views of Twin Peaks to a greater extent than Alternative B. The towers would also be visible from open space both north and south of the channel, also rising above seven- to eight-story buildings. From other residential streets of Alternative B west of Third Street, the 22-story buildings would be visible depending upon siting and configuration of buildings near the viewer. The residential towers would also be visible above other Mission Bay buildings from streets in South of Market, and from upper floors of high-rise buildings downtown.

The buildings of this variant would cast longer shadows than those of Alternative B, but those shadows would not reach public open space outside the Project Area. As in Alternative B, the buildings of this variant would shade Mission Bay open space north of the channel in afternoon hours during various times of the year.

The 220-foot towers could increase ground-level wind speeds in sidewalk and open space areas near Fifth and King Streets. Wind-tunnel testing would be appropriate when actual architectural and site plans for the towers and buildings in the vicinity are available.

GEOLOGY AND SEISMICITY

The 22-story MHDR buildings would be pile-supported. There would be increased danger to pedestrians from falling glass and cladding during an earthquake. The potential for damage and injury from movement of the contents of the buildings would be higher on the upper stories, depending on the rigidity of the buildings and their response to frequencies of earthquake motions. Other potential earthquake impacts would be the same as described in Alternative B (p. VI.K.42).



PROJECT AREA

PROJECT AREA BOUNDARY

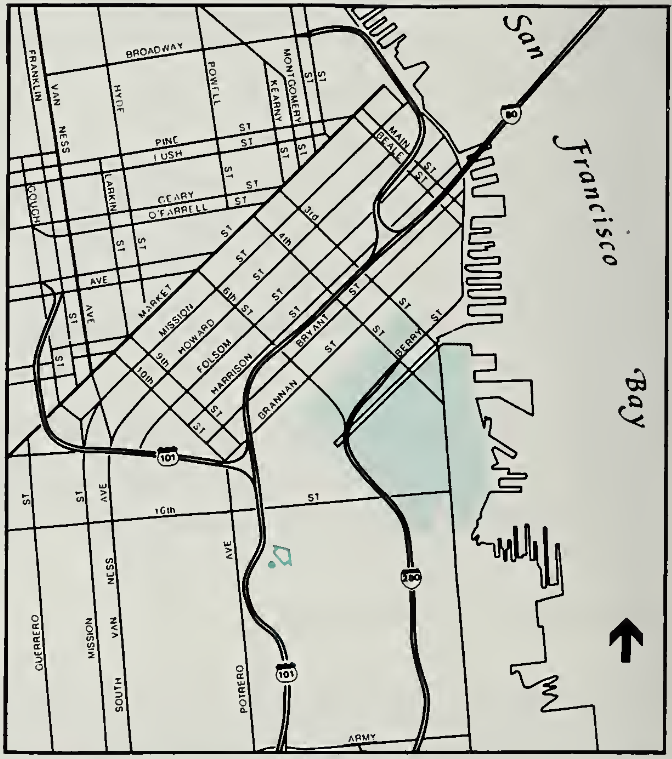
HEIGHT LIMITS (Lines drawn at furthest point from Potrero Hill viewpoint):

220 feet

110 feet

40 feet

GROUND LEVEL


San Francisco Bay
BROADWAY
FRANKLIN
VAN NESS
HYDE
POWELL
KEARNY
MONTGOMERY
ST
PINE
BUSH
GEARY
O'FARRELL
LARKIN
GOUGH
MAIN
BEALE
80
3rd
4th
MARKET
MISSION
6th
HOWARD
9th
10th
FOLSOM
HARRISON
BRYANT
BRANNAN
BERRY
AVE
101
16th
GUERRERO
MISSION
SOUTH VAN NESS
POTRERO
280
ARMY

The photograph was taken from the roof of Patrick Henry School, 639 Vermont Street near 18th Street, to provide an unobstructed view of the Project Area. Although the viewpoint is not publicly accessible, it is similar to views partially available from streets and residences on Potrero Hill.

FIGURE VII.7
VIEW FROM POTRERO HILL
INCREASED HOUSING HEIGHT (ALTERNATIVE B)

SOURCE: Roger Owen Boyer and Associates

OTHER TOPICS

Other environmental effects of this variant would be the same as those of Alternative B (see VI.A. Public Plans, Policies, and Permits, p. VI.A.34; VI.B. Land Use, Business Activity, and Employment, starting on p. VI.B.80; VI.C. Housing and Population, starting on p. VI.C.64; VI.D. Community Services and Infrastructure, starting on p. VI.D.32; VI.E. Transportation, beginning on p. VI.E.83; VI.F. Air Quality, starting on p. VI.F.11; VI.G. Noise, pp. VI.G.17, VI.G.23, VI.G.26; VI.H. Energy, p. VI.H.7; VI.J. Cultural Resources, p. VI.J.20; VI.L. Hydrology and Water Quality, pp. VI.L.14, VI.L.18, VI.L.21, VI.L.28, VI.L.30; VI.M. Vegetation and Wildlife, pp. VI.M.9, VI.M.17; VI.N. Hazardous Wastes, p. VI.N.38, and VI.O. Growth Inducement, pp. VI.O.1–VI.O.9).

MITIGATION

Mitigation measures included for Alternative B would apply to this variant. (See Mitigation sections in Chapter VI. Environmental Setting, Impact and Mitigation.) In addition to those measures, the following would be necessary:

- Potential wind effects of buildings over 100 feet in height would be reviewed by a qualified wind consultant. The review would evaluate the need for wind break features or further detailed wind-tunnel studies of the proposed structures.

7. OFFICE AS A PRIMARY USE IN S/LI/RD DEVELOPMENT (ALTERNATIVES A AND B)

As defined for the Alternatives, S/LI/RD in Alternatives A and B would be characterized by service industrial, light industrial, research and development, institutional and wholesale/showroom uses (see V. The EIR Alternatives and Approval Process, pp. V.2–V.3). There is no S/LI/RD land use designation in Alternative N. Office would be allowed only as an accessory activity to the primary non-office functions of the users of the S/LI/RD development in Alternatives A and B. This section considers the implications of a change in the S/LI/RD designation to allow office as a primary use.

DIFFERENCE IN PROJECT AREA EMPLOYMENT AT BUILD-OUT/2020

The employment estimate for S/LI/RD in Alternatives A and B is based on assumptions about the mix of activities in that type of development and an appropriate employment density factor reflecting that mix (see Table XIV.A.2, p. XIV.A.10). Employment densities for S/LI/RD activities are generally lower than they are for office activities (i.e., S/LI/RD activities use more space per worker). If office were a major component of S/LI/RD development in Mission Bay, there would be more employment associated with that land use designation.

Alternative A

The magnitude of the potential difference in Project Area employment would depend on the amount of space that would be occupied by office activities. For example, if one-half of the S/LI/RD development in Alternative A were occupied at an employment density similar to that for office activity in a relatively low-density business park, then Project Area S/LI/RD employment at build-out would be about 9,900 instead of 8,400./3/ The difference of about 1,500 office workers would represent about 18% more S/LI/RD employment and about 6% more total employment in the Project Area. If more than half of the S/LI/RD development were occupied by office activities, the difference in employment for Alternative A would be greater than 1,500 workers. If less than half were occupied by office activities, there would be a smaller difference in employment.

Alternative B

Alternative B has a small amount of development in the southeast corner of the Project Area designated for S/LI/RD uses. By comparison to Alternative A, Alternative B S/LI/RD development would be less likely to attract office businesses because of its distance and isolation from other office activity. However, if, for example, one-half of the S/LI/RD development in Alternative B were occupied by office activities, there would be about 1,100 workers in S/LI/RD development instead of 900 at build-out./3/ The difference of 200 office workers would represent about 22% more S/LI/RD employment but only about 3% more total employment in the Project Area.

LAND USE, BUSINESS ACTIVITY, AND EMPLOYMENT

Allowing office as a primary use in S/LI/RD development would result in somewhat more total employment and job opportunities in the Project Area than would the more restrictive S/LI/RD designation assumed for Alternatives A and B. The difference in the character of S/LI/RD activity also would affect the mix of types of jobs in the Project Area. For both Alternatives A and B, more office businesses in the Project Area would result in more jobs for clerical and professional/technical workers and fewer jobs for service and craft/operative/other workers.

Most additional employment in the Project Area as a consequence of allowing office as a primary use in S/LI/RD development would be employment that otherwise would be elsewhere in San Francisco, most likely in other parts of the Downtown & Vicinity, particularly South of Market and Civic Center/South Van Ness. Thus, from the cumulative perspective, the activity already is included in the employment growth scenarios analyzed in the EIR. Even if the additional Project Area employment were added to the cumulative scenarios, the amount is not large enough to make a difference in the citywide and regional scenarios or the implications of those scenarios.

HOUSING AND POPULATION

Implications for the Office Affordable Housing Production Program Requirements (OAHPP)

Alternative A

- More office employment in Mission Bay would mean larger OAHPP requirements. For Alternative A, assuming (for example) that one-half of S/LI/RD development were occupied by office activities and would be subject to the OAHPP, the additional in-lieu fee required would be about $12.5 million. To satisfy the OAHPP requirement with housing development would mean an additional 695 units in this example, 431 to be affordable to moderate- or lower-income households. The number of housing units to be built in the Project Area under Alternative A (7,700) would more than satisfy the total OAHPP housing construction requirement (2,278 units counting the units associated with office activity in S/LI/RD development in this example). The OAHPP affordability requirement would be satisfied if 18.3% of the 7,700 units were ownership units at prices that, on average, are affordable to households of median income and/or rental units at rents that, on average, are affordable to households at 60% of median income.

Alternative B

- For Alternative B, assuming (for example) that one-half of S/LI/RD development were occupied by office activities, the OAHPP requirement would be satisfied by either an additional $1.5 million in-lieu fee, or construction of 81 housing units, 50 to be affordable to moderate- or lower-income households. The number of housing units to be built in the Project Area under Alternative B would more than satisfy the total OAHPP housing construction requirement (467 units counting those associated with office activity in S/LI/RD development in this example). The OAHPP affordability requirement would be satisfied if 2.9% of the 10,000 units were ownership units at prices that, on average, are affordable to households of median income and/or rental units at rents that, on average, are affordable to households at 60% of median income.

Implications for the Project Area Jobs/Housing Relationship

Alternative A

More total employment in the Project Area would mean more overall housing demand associated with Project Area employment growth. For Alternative A, the additional employment (assuming the example where one-half of S/LI/RD development would be occupied by office activity) would result in the need for about 230 additional housing units to accommodate the additional San Francisco households with Project Area workers, including about 180 additional units in the affordable category. With this variant, the number of housing units built under Alternative A (7,700) still would exceed the number of units needed to accommodate Project Area employment growth (about 3,740 units counting those associated with office activity in S/LI/RD development). With office activity in S/LI/RD development, the number of affordable housing units needed would represent about 38% of housing in Alternative A, a higher percentage than the 30% assumed to be priced at affordable levels, and a higher percentage than the 36% estimated for Alternative A without office activity in S/LI/RD. Some households with Project Area workers would have incomes below the levels needed to pay the affordable new housing prices assumed for Alternative A. The number of such households would be larger with office activity in S/LI/RD development than it would without the additional office employment. (The discussion for Alternative A of the implications of these estimates would apply to this variant as well. See pp. VI.C.70-VI.C.75.)

Alternative B

For Alternative B, the additional employment (assuming the example where one-half of S/LI/RD development would be occupied by office activity) would contribute the need for about 35 additional housing units, including about 30 affordable units. The number of housing units built in the Project Area still would exceed by a large amount the number of units needed to accommodate Project Area workers (10,000 units built compared to about 755 units needed). With office activity in S/LI/RD development, the number of affordable housing units needed would represent about 6% of new housing in Alternative B, a lower percentage than the 30% assumed to be priced at affordable levels. The 6% share is approximately the same as estimated for Alternative B because the number of additional affordable units associated with the additional employment (due to office activity in S/LI/RD) would be small relative to the large number of new housing units in Alternative B. There would be a small number of households with Project Area workers unable to pay the affordable new housing prices assumed. (The discussion for Alternative B of the implications of these estimates would apply to this variant as well. See pp. VI.C.75-VI.C.76.)

Implications for Housing Market Conditions

Since the larger amount of employment in the Project Area as a consequence of allowing office as a primary use in S/LI/RD development would most likely represent a shift of business activity that would otherwise locate elsewhere in the City, there would be no difference in cumulative housing demand with this variant. Consequently, the conclusions about implications for citywide and regional housing market conditions described in VI.C. Housing and Population, Impact: pp. VI.C.81-VI.C.86, would still apply.

COMMUNITY SERVICES

Any increase in employment would produce a small proportionate increase in demands for community services. Schools would not likely be affected.

TRANSPORTATION

More Project Area employment also would mean more travel at certain locations and intersections. Effects on local travel would depend on whether the additional employment was concentrated in one or two buildings or blocks, or spread out over the area designated for S/LI/RD development, and the amount of space that would be occupied by office activities.

Parking deficits would increase with the addition of office use in S/LI/RD space, because office use generates an excess parking demand (and therefore parking deficits). The effect would be compounded by the reduction of S/LI/RD space, which generates an excess of parking supply relative to demand.

Alternative A

Using the example presented on p. VII.42, if one-half of the S/LI/RD development in Alternative A were occupied by office activity, the increased employment would generate a corresponding increase in p.m. peak travel demand leaving the Project Area (about 18% more from S/LI/RD areas and about 6% more from the entire Project Area). Effects on intersections near the S/LI/RD areas could be noticeably different from those identified in VI.E. Transportation, if the additional employment were concentrated in a small area, especially along the Third Street corridor where a Level of Service (LOS) E is projected at the Third/Mariposa Street intersection. If it were spread over the area designated for S/LI/RD development, the differences would be less noticeable and perhaps, there would be no significant differences, depending on the amount of S/LI/RD development that would be accommodating office employment.

Alternative B

Using the example presented on p. VII.43, if one-half of the S/LI/RD development in Alternative B were occupied by office activity, the increased employment would generate a corresponding increase in p.m. peak travel demand leaving the Project Area (about 22% more from the S/LI/RD area and about 3% more from the Project Area). Since the S/LI/RD uses would be concentrated in the southeast corner of the Project Area, effects on intersections would be limited to the Third/Mariposa Street intersection. Project Area traffic would contribute 5% of the total p.m. peak-hour traffic through this intersection under Alternative B. The increase in traffic generated by office activity in the S/LI/RD area would not change the projected LOS D at this intersection.

The cumulative transportation analyses for Alternatives A and B would not change significantly if office were allowed as a primary use in S/LI/RD development. The conclusions in VI.E. Transportation about screenline travel and the implications for various systems would still apply.

AIR QUALITY, NOISE, ENERGY

Additional travel would produce air quality emissions proportionate to the increase in employee travel. Traffic noise could also increase, but the increase would not be noticeable. Transportation energy consumption would also increase proportionately.

GROWTH INDUCEMENT

Since the larger amount of employment in the Project Area as a consequence of allowing office as a primary use in S/LI/RD development would be employment that otherwise would be located elsewhere in San Francisco, the change in the S/LI/RD designation represented by this variant would not result in further additions to citywide employment growth or to associated population growth when compared to Alternatives A and B. As in Variant 5, there would be relatively less pressure for growth and change in Nearby Areas due to office development (particularly in South of Market and Civic Center / South Van Ness areas) and relatively more pressure due to S/LI/RD development (particularly South of Market and in the closer-in parts of older industrial areas west and south of the Project Area).

OTHER TOPICS

Other environmental effects of this variant would be the same as those of Alternative A or B, as appropriate (see VI.A. Public Plans, Policies, and Permits, starting on p. VI.A.34; VI.I. Architectural Resources and Urban Design, starting on p. VI.I.24; VI.J. Cultural Resources, starting on p. VI.J.14; VI.K. Geology and Seismicity, starting on p. VI.K.19 VI.L. Hydrology and Water Quality, starting on p. VI.L.13; VI.M. Vegetation and Wildlife, starting on p. VI.M.7, and VI.N. Hazardous Wastes, starting on p. VI.N.18).

8. VARIATIONS IN THE PERCENTAGE OF AFFORDABLE HOUSING AND THE SIZE OF AFFORDABLE UNITS (ALTERNATIVES A AND B)

The analysis in the EIR assumes that 30% of the new housing units in Alternatives A and B would be "affordable" in accordance with the Mayor's Letter with an average size of 850 square feet./4/ This section addresses implications of variations in that percentage, assuming the same total number of units in each Alternative. This section also considers the implications of changes in the sizes of affordable units such that more larger units and fewer smaller units are built, and the overall average unit size for affordable housing is larger. Each of these variations is discussed under the topics that follow.

DIFFERENCES IN PROJECT AREA POPULATION AT BUILD-OUT/2020

The amount of affordable housing in Mission Bay could have some effect on the total number of Project Area residents since the affordable units are assumed to have more people per unit than the other housing. Assuming the same total number of housing units in the Project Area and the same mix of unit sizes, variations in the percentage of affordable housing would make only small differences in total Project Area population, however. For example, increasing the percentage of units that are affordable from 30% to 35% could result in about 1% more people in the Project Area in Alternatives A and B, assuming the same mix of unit sizes and the same persons-per-household factors continued to apply. That difference could represent about 180 more people added to the population estimate of 14,400 for Alternative A at build-out and about 230 more people added to the population estimate of 18,670 for Alternative B at build-out.

The mix of sizes of affordable units also could affect Project Area population. More larger units (those with two, three and four bedrooms) and fewer smaller units (studios and one-bedroom units) could result in a larger total population in Mission Bay. For example, a change in the mix of sizes of affordable units resulting in an overall average unit size for the affordable housing that was 10% larger than assumed in Alternatives A and B could result in about 10% more people in the affordable units (assuming the same persons-per-household factors for units of various sizes). This larger number of people in affordable housing would represent about 3.5% more total Project Area population in Alternatives A and B. For Alternative A at build-out, an overall average unit size for affordable housing that was 10% larger could result in about 500 more people added to the total population estimate of 14,400 for that Alternative. For Alternative B at build-out, that increase in unit size could result in about 650 more people added to the total population estimate of 18,670 for that Alternative. If increases in the percentage of affordable housing were combined with changes resulting in more larger units, the Project Area population would be slightly larger than described above.

HOUSING AND POPULATION

Implications for the Characteristics of Households and Population

Since affordable units would have relatively low prices and rents, the more affordable units built, the more Project Area households there would be with relatively low incomes. Compared to the situations assumed for Alternatives A and B, more affordable units also could mean relatively more children and elderly residents. In general, however, the Mission Bay residential neighborhood would accommodate a broad range of different households and people under any variations in the amount of affordable housing provided. (See VI.C. Housing and Population, pp. VI.C.64–VI.C.67.)

Changes in the sizes of affordable housing units resulting in more larger units and fewer smaller units could mean more families with children residing in Mission Bay and fewer households of only adults, particularly elderly adults. Thus, much of the increase in population that could occur with larger units would represent additional children in affordable housing in the Project Area. There could be some more adults, with relatively fewer elderly individuals and relatively more younger adults. Overall, Project Area population could be relatively younger.

Implications for the Project Area Jobs/Housing Relationship and for the City's Housing Market

Implications of Increases in the Percentage of Affordable Housing

Affordable housing in the Project Area helps to accommodate households of those working in the Project Area as well as to satisfy other housing demand (from households with persons working elsewhere in the City and region as well as households without workers). The relationship between Project Area employment growth and housing development in Alternatives A and B is described in VI.C. Housing and Population, see pp. VI.C.70–VI.C.76. The following discussion uses that analysis of the match between Mission Bay housing and households with Project Area workers (under the assumption that 30% of the units would be affordable) to examine the potential increases in the percentage and number of affordable units, and how variations would affect the conclusions of the jobs/housing analysis for Alternatives A and B. No changes in the range of prices and rents for the affordable housing are assumed.

The amount of affordable housing in the Project Area also has implications for citywide housing market conditions. In general, the more affordable housing added in San Francisco, the more positive the contribution to the City's housing market since such units are difficult to produce and will continue to be in strong demand.

Alternative A. Alternative A would add a large amount of affordable new housing in the City (assuming 30% affordable units). For that Alternative, the number of additional San Francisco households with Project Area workers requiring affordable housing is estimated to represent about 36% of the new housing in Alternative A instead of 30% (see p. VI.C.74). Thus, if the percentage of affordable housing were higher than 30%, that would improve the ability of Project Area housing to accommodate Project Area employment growth. If it were higher than 36%, it would improve the ability of Project Area housing to accommodate other demand for affordable housing in the City (besides that associated with Project Area employment growth).

- Increases in the number of affordable units without changes in the range of prices and rents for affordable housing would not affect Alternative A's ability to meet the OAHPP requirements (see p. VI.C.70).

In order to retain the land use programs of Alternatives A and B together with the CalTrain terminal at Fourth Street, construction of a subway for CalTrain from approximately 16th Street north and east to an underground station at Fourth and King Streets would be required. King Street, rather than Townsend Street, would be the site of the underground station, as that location is compatible with convenient passenger transfer from a stop on the proposed MUNI Metro line on King Street, and is a location for which an easement could be provided. Optimally, construction of the subway should occur prior to SFP's development of the blocks north of China Basin Channel and west of Fifth Street, and before the new I-280 ramps are built, King Boulevard is upgraded, and the MUNI Metro line is extended, in order to reduce construction costs and avoid traffic disruption.

If the underground Fourth and King Streets station remained the San Francisco terminus for CalTrain, then the impacts presented for 2000 and build-out/2020 in VI.E. Transportation, for Alternatives A and B would change as follows:

- If the CalTrain terminal remained at Fourth and King Streets, CalTrain's future ridership at this terminal could be up to about 22% higher at that time according to one study than if the terminal were moved to Seventh and Channel Streets, as in Alternatives A and B /5a/; ridership on BART (West Bay) and SamTrans would be about 9% and 11% lower, respectively, than the forecasts for the South Bay screenline presented in Tables VI.E.14–VI.E.20 pp. VI.E.106–VI.E.109, VI.E.115–VI.E.122, and p. VI.E.130. The percentages of outbound person trips by mode from the Downtown & Vicinity would be identical for Alternatives A and B with those shown for Alternative N in Table VI.E.7, p. VI.E.77. As a result, future levels of service would be as listed in Table VII.1.

  All three transit operators would continue to operate at comfortable to excellent levels of service, with no significant differences projected from the original forecasts.

- Vehicle volumes on Highway 101 and I-280 at the South Bay screenline in 2000 and 2020 would be about 5% less than the volumes presented in Table VI.E.15, p. VI.E.108. For U.S. 101, this would not result in any substantial change in the duration of congestion (about 2.5 hours in 2000, about 3.3 hours in 2020) or operating Levels of Service during the afternoon commute period.

- MUNI bus routes which would continue to serve the CalTrain Station at Fourth and King Streets, might not be extended to Seventh and Channel Streets, but could be extended past Fourth and King Streets through the Project Area on different alignments. The 30-Stockton could still be extended through the Project Area to eastern Potrero Hill, but along a more easterly routing. From the CalTrain Station at Fourth and King Streets, MUNI Metro rail tracks for storage would extend 1,000 feet west to about Fifth and King Streets. MUNI Metro could be extended west to the Showplace Square Area or south into the Project Area across the Owens Street Bridge.

TABLE VII.1: LEVELS OF TRANSIT SERVICE WITH NO CALTRAIN TERMINAL RELOCATION •

	CalTrain		BART		SamTrans	
	D/C/a/	LOS/b/	D/C	LOS	D/C	LOS
	P.M. Peak Period					
2000						
Alternatives A and B	0.63	B	0.80	B	0.59	B
2020						
Alternative A	0.76	C	0.85	C	0.66	B
Alternative B	0.71	B	0.71	B	0.61	B
	P.M. Peak Period					
2000						
Alternatives A and B	0.65	B	0.66	B	0.50	B
2020						
Alternative A	0.77	C	0.73	B	0.59	B
Alternative B	0.71	B	0.71	B	0.54	B

/a/ Demand to capacity ratio (D/C) equals passengers per seat provided. For consistency of this analysis, the unit of seats has been used to define capacity (see p. XIV.E.16 for more discussion). Capacity for 2020 is assumed to be the same as that projected for 2000.

/b/ Level of Service, as defined in Transportation Research Board, Circular 212.

SOURCE: Barton-Aschman Associates, Inc.

- The peak pedestrian concentration would not be at Seventh and Channel Streets, but would remain as it is now with pedestrian travel from downtown north of Fourth and Townsend Streets. The number of pedestrians arriving at the CalTrain terminal, including those alighting from MUNI vehicles, would be about 22% higher than with the terminal at Seventh and Channel.

An underground station at Fourth and King Streets could serve as a temporary terminal if CalTrain service was extended into downtown. In that case, the impacts would be identical to those described above, because this would continue to be the major transfer point between MUNI and CalTrain until the extension into the downtown was completed.

Once the CalTrain extension into downtown was completed, the function of the Mission Bay station would change, as this would be a way station serving primarily Mission Bay, Showplace Square South of Market and South Beach travelers. Requirements for MUNI bus and Metro capacity would be lower than if the Fourth and King Street Station were to remain CalTrain's terminus. Pedestrian volumes during peak periods would also be correspondingly lower on sidewalks and at crosswalks directly adjacent to or leading to Fourth and King Streets.

In June 1988, the voters of San Mateo County approved a sales tax increase to be used for transportation improvements. This ballot measure would generate $200 million toward the extension of CalTrain to downtown, about half the total estimated cost. Detailed analysis of the impacts of the CalTrain extension would be prepared for that project when the extension secures its full required funding commitment. This summary presents only the variations in impacts that would occur with this variation of the baseline description of EIR Alternatives A and B.

10. REDUCED SEISMIC HAZARD (ALTERNATIVES A, B, AND N)

- Most of Mission Bay is former bayland or marsh. Some of these areas are subject to liquefaction and "violent" and "very strong" groundshaking in the event of a great earthquake (see VI.K. Geology and Seismicity, pp. VI.K.33–VI.K.37). Anticipated maximum groundshaking intensity at the site was mapped by ABAG (1987) using geologic characteristics and distance from faults./5b/ ABAG's groundshaking estimates at some locations in the Project Area differ slightly from values mapped by Wood in 1908 /5c/ and Blume in 1974 /5d/. The older maps are based on incomplete data from the Project Area for the 1906 event and are less conservative estimates of future groundshaking intensities than the ABAG estimates. For the purposes of this variant, we refer only to ABAG's On Shaky Ground "Maximum Ground Shaking Intensity" map that provides analysis of the worst-case seismic scenario.

- A seismically safe variant to the Mission Bay Alternatives would limit development to those areas estimated to undergo only "very strong" groundshaking as shown on ABAG's On Shaky Ground maps./5b/ Commercial and residential development that would otherwise occur in Mission Bay would thus be directed to other, seismically safer locations in the City and the region, limiting the number of employees and residents exposed to seismic hazard. There are no locations in Mission Bay where maximum groundshaking would be "strong" or less intense. If policy were established to permit new development only in areas experiencing "strong" or "weak" groundshaking, no new development could occur in Mission Bay or much of San Francisco.

There are two areas of "very strong" groundshaking, where bedrock is near the surface, in the Project Area. Development in these areas would be limited to: 1) the northeastern corner of the Project Area, near Townsend Street west of Third; and 2) the southwestern corner south of 16th Street along I-80. It is assumed that office development would occur on the northeastern parcel (as in Alternatives A and N), and that M-2 Industrial or S/LI/RD uses would occur on the southwestern parcel (as in Alternatives A and N). The

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rest of the Mission Bay Project Area would either remain in rail yards and low-intensity warehousing and trucking industry uses or could become vacant as rail uses were removed. The environmental effects of this variant would be similar to those described for Alternatives A and N for the northeastern and southwestern corners of the Project Area. There would be no new adverse environmental effects in other portions of the Project Area, and conditions would remain as they are described in the Setting sections of Chapter VI. Environmental Setting, Impact and Mitigation. The area would remain underused, and contaminated soils likely in certain portions of the area would remain.

A plan that would severely limit development in the Mission Bay area and shift development to other areas of the City is unlikely. San Francisco has little vacant land that is not subject to very strong or violent groundshaking, and no other areas of potential development as large as the 325-acre Mission Bay area. It is not reasonable to redevelop large portions of areas such as the Richmond or Sunset Districts into the higher-intensity development described for the Mission Bay Alternatives, because those areas are essentially fully developed with housing and neighborhood-serving commercial uses. While some areas of the South Bayshore include areas that could be seismically "safer" than Mission Bay, they too are already developed, and provide some of the last remaining industrially zoned areas in the City.

The less vulnerable areas just north of the Mission Bay Project Area, such as Rincon Hill or portions of the eastern South of Market, are equally inappropriate to receive development proposed for Mission Bay. Rincon Hill recently has been rezoned and planned for high-intensity residential development, much of which is at least as dense as the residential areas proposed under Alternatives A and B. South of Market is presently under study, with proposals from both the City and members of that community generally supporting retention of this area for light industrial and entertainment uses, with office uses already proposed for the eastern end along Second Street.

San Francisco has no jurisdiction to direct growth to specific locations outside of its boundaries such as "seismically safer" areas of Marin or San Mateo Counties. Thus, implementing a seismic safety variant using this route would essentially establish the status quo, as described in the Setting sections of the EIR, as the limit of development in Mission Bay. Much of the demand for commercial and residential space would then be met elsewhere in the San Francisco Bay Area, as discussed in VI.B. Land Use, Business

Activity, and Employment, p. VI.B.119. There is no way to guarantee that this development would occur on seismically safer soils, however. Spreading development throughout the region has the potential for other impacts, such as transportation problems if less transit is available for commuting to work than in the Downtown & Vicinity.

- Proposing a plan that included development of industrial uses in most of the Project Area would essentially duplicate the M-2 District development assumed under Alternative N. Because that Alternative shows employment of about 17,000, only 6,000 of whom might be accommodated in the slightly more "safe" area of Townsend and Third, even this Alternative could be said to expose large numbers of people to seismic hazard. (While it would be technically possible to develop parklands in the most seismically active areas of Mission Bay, that development is not likely to be economically feasible due to the limited amount of developable land elsewhere in the area that would be available to support park development, and due to the expense of cleaning up contaminated soils likely to be found in portions of the area.)

Mitigation measures identified for Alternatives A, B, and N (see VI.K. Geology and Seismicity, pp. VI.K.45-VI.K.56) would substantially reduce the seismic hazards associated with building construction in the Project Area. Those mitigation measures would require more stringent standards than are now required in the San Francisco Building Code. Thus, structures in Mission Bay could be more seismically sound than structures built concurrently in other portions of the City. In addition, the Bureau of Building Inspection expects to propose to the Board of Supervisors in 1989 revisions to the San Francisco Building Code, which would reflect seismic updated standards in the 1988 Uniform Building Code./6/ Thus, while a seismically safer variant would expose fewer people to seismic hazards in Mission Bay, it is likely that development elsewhere would expose them to similar hazards. Hazards in Mission Bay would be reduced by the seismic requirements of the San Francisco Building Code, possibly augmented by mitigation measures for Mission Bay if they were adopted.

• 11. EIR HEARING PROPOSAL (ALTERNATIVE B)

DESCRIPTION

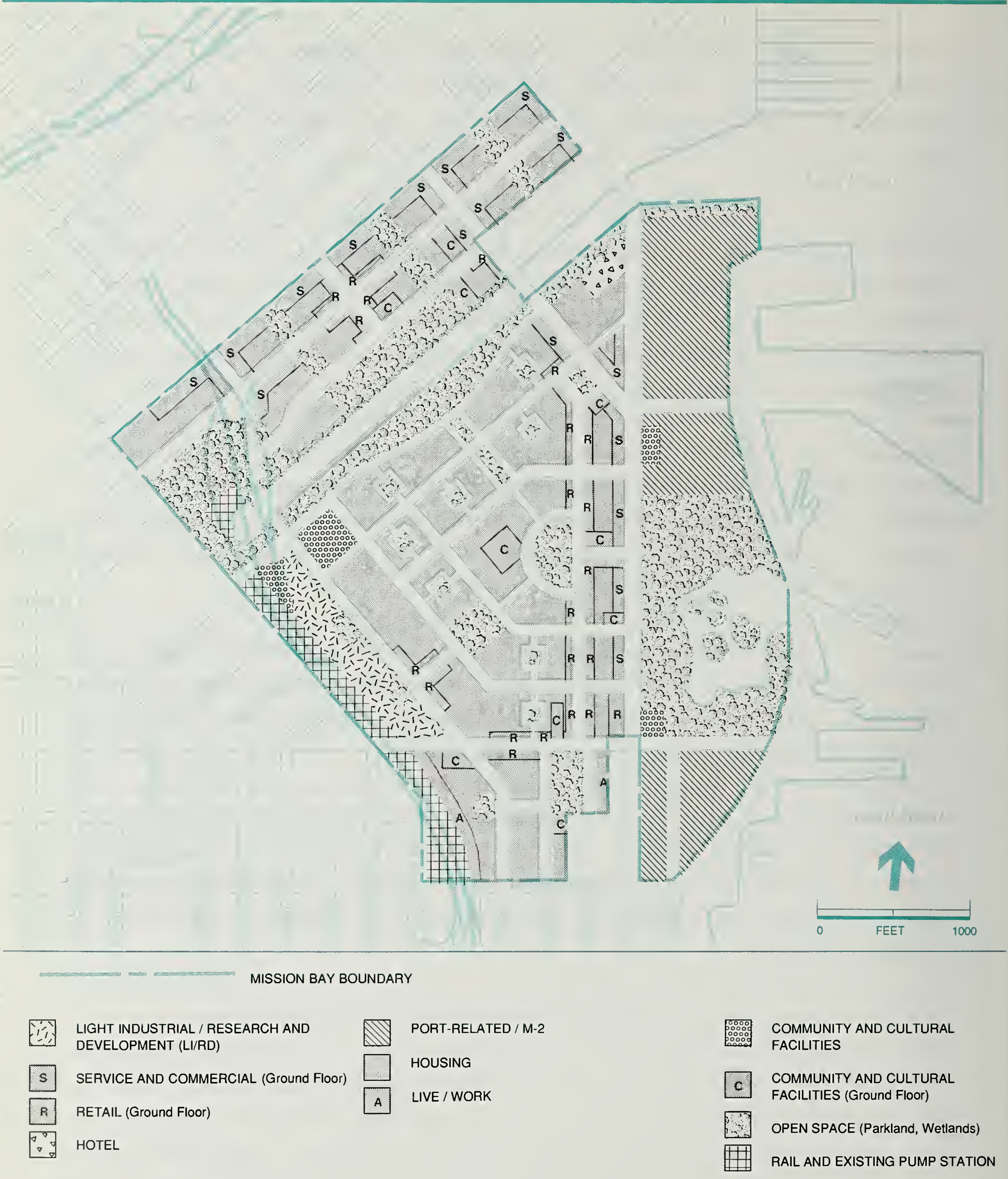
The distribution of land uses in this variant is most closely related to Alternative B's land use distribution west of Third Street. It has about 10% more jobs than Alternative B, and the amount of housing provided would fall between the amounts in Alternatives A and B. Port uses and open space are included east of Third Street in place of housing with the intention of preserving the option of port development at Mission Bay. (Impacts of locating port-related uses east of Third Street also are evaluated in Variant 2, Port-Priority Retention, p. VII.10.) The land use plan and program for the variant are shown in Figure VII.8.

The variant places more emphasis on "affordable" housing than do EIR Alternatives A and B; 50% of the housing units would be "affordable" under the variant, rather than 30% under Alternatives A and B. At least one-half of the units would be "family-sized" units (two bedrooms or more). While not precluded under Alternatives A or B, this variant specifically includes 200 live/work units which would provide combined living and working space for artists or crafts workers.

The variant provides about the same amount of open space as does Alternative B, and includes one 20-acre wetland along the Bay shore. Open space would provide a variety of active as well as passive recreation areas, and features such as community gardens and recreation centers. An indoor, olympic-sized swimming pool and gymnasium could be included near the Sixth Street interchange.

Space for a wider variety of community and cultural facilities would be provided by the variant than by Alternatives A and B. Community and cultural facilities in the variant would include publicly owned uses similar to those defined as community facilities in Alternatives A and B, as well as privately owned facilities such as theaters, child care centers, and art galleries. Such use would not be precluded in Alternatives A and B. Community facilities in the variant could include a library, senior center, health center, recycling center, school, fire and police facilities, MUNI yard, and the existing pump station. The rehabilitated fire station at the intersection of Third, Fourth and Mission Rock Streets and at the northeast corner of Third and 16th Streets would be used for community facilities.

No office buildings are proposed in the variant. A 400-room hotel would be located in the northern portion of the "banana triangle" adjacent to HDR. The variant would provide more retail space than Alternatives A or B would (about twice as much retail space as that in Alternative A and about two-thirds more retail space than that in Alternative B). Most of the retail space would be located on the ground floor of residential buildings. There would be a corridor of retail uses along Long Bridge Street, parallel to and west of Third Street. The retail space would consist primarily of shops, stores, and eating and drinking places as found along a typical neighborhood commercial street. A supermarket could be developed at the intersection of 16th and Third Streets.


0 FEET 1000
MISSION BAY BOUNDARY
LIGHT INDUSTRIAL / RESEARCH AND DEVELOPMENT (LI/RD)
S SERVICE AND COMMERCIAL (Ground Floor)
R RETAIL (Ground Floor)
HOTEL
PORT-RELATED / M-2
HOUSING
A LIVE / WORK
COMMUNITY AND CULTURAL FACILITIES
C COMMUNITY AND CULTURAL FACILITIES (Ground Floor)
OPEN SPACE (Parkland, Wetlands)
RAIL AND EXISTING PUMP STATION

Mission Bay

• FIGURE VII.8
EIR HEARING PROPOSAL
(ALTERNATIVE B)

SOURCE: Environmental Science Associates, Inc.

The variant provides space for Light Industrial / Research and Development (LI/RD) uses, similar to the S/LI/RD uses in Alternatives A and B, and introduces a new specific use category, Service/Commercial.

Service/Commercial space would be located on the ground floor of residential structures, primarily along major streets (e.g., Townsend and Third Streets). The mixed-use buildings providing Service/Commercial space would be of relatively high-quality construction with attention to design and amenities. Parking generally would be incorporated in the structure.

Service/Commercial would be flexible space, able to accommodate a variety of types of businesses. The space generally would be designed to accommodate smaller users. The types of businesses likely to locate in Service/Commercial space are as follows:

- Small professional service firms such as architectural, engineering, and other consultant service firms, design firms, advertising agencies, and public relations companies;
- Business services firms such as data-processing, record-keeping and personnel agencies, branch banks, travel agencies, real estate agencies, and insurance agencies;
- Administrative support offices for small manufacturing, publishing, and distribution companies, and trade associations;
- Reproduction and printing shops;
- Office supply and equipment sales and repair shops;
- Communications and delivery businesses;
- Home improvement, hardware, and building materials suppliers; and
- Retail, entertainment, and eating and drinking establishments oriented to a broad market area.

There would be some differences between the types of Service/Commercial activities north and south of the channel. Most Service/Commercial space north of the channel is likely to be occupied by office-type activities. South of the channel, there would be a greater mix of small office uses, commercial services and retail activities.

The 20 houseboat berths and 35 pleasure-craft berths in China Basin Channel would remain. As in the EIR Alternatives, the I-280 stub and Fourth Street off-ramp would be removed and the interchange reconfigured to provide on- and off-ramps at King Street near Sixth Street.

CalTrain would follow its present route, but would gradually descend below grade, from north of 16th Street to about Seventh and Hooper Streets; from there it would continue underground. The route would lie beneath King Street. The existing CalTrain station would be replaced by an underground station between Third and Fourth Streets. MUNI Metro would follow the same corridor above ground along King Street west to the MUNI yard near Seventh and Channel Streets.

Outside the Project Area, the wetland park would require construction of a bridge carrying China Basin Street over the connection between the Bay and the proposed wetland.

The variant is most similar to Alternative B in terms of total employment. Total employment would be about 6,700 jobs, 8% more than that in Alternative B and 73% less than that in Alternative A. The most employment in the variant would be associated with the Service/ Commercial land use category. This space is estimated to accommodate about 1,960 jobs in a mix of small office, retail, and commercial businesses. Retail and LI/RD are the other major employment categories.

The variant would preserve some port-related jobs that would be eliminated by Alternatives A and B. It would also provide hotel employment similar to Alternative A, employment that would not be provided in Alternatives B or N. The amount of employment associated with community facilities, open space, and building maintenance/security/parking would be similar to the amount in Alternative B. In addition, the variant would provide an estimated 350 jobs in a new live/work land use category.

The number of housing units in the variant falls between the number of units in Alternatives A and B (about 800 [10%] more units than in Alternative A and 1,500 [18%] fewer units than in Alternative B). The number of households would fall similarly in between Alternatives A and B.

PUBLIC PLANS AND POLICIES

With its emphasis on Port-Related / M-2 uses east of Third Street and mixed-use development west of Third Street, the variant would be more responsive to existing plans and policies applicable to Mission Bay than would Alternatives A or B. The City's Central Waterfront Plan, the Port's Conceptual Maritime Master Plan for the Southern Waterfront, and the regional Seaport Plan encourage the maintenance or expansion of maritime uses east of Third Street in Mission Bay. Port-related uses east of Third Street are consistent with those policies. The variant is intended to preserve the option for a future container terminal at Mission Bay, consistent with Metropolitan Transportation Commission (MTC) and San Francisco Bay Conservation and Development Commission (BCDC) policies./7/

It is proposed that the wetland park located within the BCDC Port Priority Area could be removed at some later time to allow for future port expansion, if necessary. As with Alternative B, however, the wetlands, once developed, would come under BCDC permit jurisdiction. BCDC approval would be needed for filling the wetlands. However, BCDC policy discourages filling of wetlands; that, as well as public reaction, could make it difficult to remove the wetland park once established.

As noted on p. VI.A. 58, BCDC policies cover port activities, public access to the Bay, and wetlands creation and maintenance along the Bay. Both the port uses and wetland area would be responsive to BCDC policies; the priority between these uses would be a BCDC policy decision.

San Francisco's Central Waterfront Plan calls for a mixed-use residential neighborhood west of Third Street, and port-related uses east of Third Street. The variant generally would be consistent with the objectives of the plan.

LAND USE, BUSINESS ACTIVITY, AND EMPLOYMENT

Land Use Characteristics

The variant represents a change in the land use character of the Project Area commensurate with the change represented by Alternatives A and B (see pp. VI.B.81–VI.B.83). The magnitude of development under the variant could be absorbed by 2020. The Service/Commercial and retail space would generally be oriented to smaller space-users than would the S/LI/RD or office space in Alternatives A, B, and N. Consequently, it would be occupied in smaller increments and occupancy might proceed more gradually. Full occupancy of the large amount of retail space would not occur until the surrounding residential blocks were well-established.

As described below in the analysis of retail activity, the amount of retail space in the variant is large. Consequently, other uses could fill in ground-floor retail space that was not yet absorbed. Public facilities such as a library, community center, senior center, health clinic, and art gallery or other exhibit space would be suitable substitute uses. They would be in addition to the building floor areas permanently designated for community and cultural activities in the variant.

Implications for Employment and Job Opportunities in Mission Bay

The amount of employment in the Project Area under the variant would be relatively small, about 6,700 jobs, similar to the total under Alternative B (about 6,200 jobs). The mix of types of businesses and jobs in the Project Area would be different, however (see pp. VI.B.83- VI.B.88).

In terms of occupations, wage/salary categories, and earnings and skill levels, Mission Bay jobs under the variant would be most similar to jobs under Alternative B. The variant would have proportionally more jobs in sales and service occupations than any of the Alternatives, reflecting the relatively large amount of retail and other ground-floor commercial space as well as the hotel in this land use program. As a result, there also would be a higher percentage of jobs in the lower wage/salary categories. The wage/salary distribution reflects the relatively high proportion of part-time positions in retail trade and the relatively high proportion of entry-level opportunities in retail, hotel, and service businesses.

The share of jobs in the professional/technical occupations would be about the same as in the Alternatives, due to the preponderance of small professional and other business service offices expected to locate in Service/Commercial space, particularly north of the channel. The share of managerial/administrative and clerical jobs would be lower than under Alternatives A, B, and N, reflecting the absence of a large office complex in the variant. The share of jobs in crafts, operatives and other occupations would be lower than in any of the Alternatives. Under the variant, the number of jobs in the Project Area in this category would be about the same as in 1985; there would be less growth than expected under Alternatives A and N, but the job opportunities of this type would not decline over time as expected under Alternative B.

Over the course of the development period, the number of construction jobs generated would be similar to the number in Alternative B (9,900 person-years, see pp. VI.B.88-VI.B.90). There would be somewhat more with the variant because the undergrounding of the CalTrain from Seventh Street to Third Street would be more labor-intensive than the transportation infrastructure work under Alternative B.

Employment Benefits to the Labor Force

As under Alternatives A, B, and N, jobs in the Project Area under the variant would employ San Francisco residents as well as residents of other parts of the region (see pp. VI.B.91–VI.B.93). While (as with Alternative B) there would be fewer Project Area jobs for City residents under the variant than there would be under Alternatives A or N, the mix of types of businesses and the amount of housing in the Project Area would mean that a higher share of jobs might be held by City residents.

Implications for Industrial Land Uses and Maritime-Related Activity

The overview description of Project Area business transition and location options presented on pp. VI.B.93–VI.B.96 would apply for the variant as it applies for Alternatives A, B, and N. In addition, the connection between the Bay and the proposed wetland would displace some existing uses east of China Basin Street outside of the Project Area. The uses displaced could include the Safeharbor (boat) Service Corporation and Royal Charter Marine Division.

In the variant, about 35 acres of land east of Third Street would be designated Port-Related/M-2. This land, both north and south of the proposed wetlands and neighborhood park, could accommodate distribution, warehousing, transportation-related, manufacturing, construction-related, and maritime-related activities.

There would be more options in the Project Area for those types of businesses under the variant than there would be under Alternatives A and B, and fewer options than there would be under Alternative N. In addition to the smaller amount of land reserved for such uses in the variant compared to Alternative N, the greater mix of uses in adjacent parts of the Project Area (wetlands, parks, housing, and hotel) raises land use compatibility issues that would not exist under Alternative N. Over the long term, there could be conflicts involving Mission Bay residents, the hotel operator, and wetlands advocates and business activities east of Third Street that could be considered nuisance operations (e.g., those generating substantial truck traffic or noise, businesses with cluttered and unattractive storage yards, businesses dealing with chemicals and other waste products).

As under Alternative N, it is unlikely under the variant that there would be a major increase in maritime-related business and employment in Mission Bay. The estimates for the EIR analysis assume a modest increase over the amount of employment in 1985. (See pp. VI.B.101–VI.B.104 for a comparison of Alternatives A, B, and N with respect to maritime-related activity in the Project Area.)

Under the variant, the port-related area east of Third Street adjacent to Piers 48 and 50 could provide enough backland for potential development of a two-berth container terminal at Piers 52-64./8/ To accommodate a container terminal east of Third Street, the variant includes the stipulation that "if future expansion space is required by maritime use, the wetlands park may be relocated."/9/ Consequently, on paper, the variant, unlike Alternatives A and B, does not preclude future container terminal development that would extend into the Project Area east of Third Street. Practically, however, it might be difficult to displace the recreational open space and wetlands uses in Mission Bay (if that were required) after they had become well-established and had a strong constituency. Moreover, potential land use conflicts in the future with established residential and hotel uses across Third Street could make container terminal development in that area difficult./7/

Retail Activity

The variant incorporates a large amount of retail space (500,000 gross square feet), substantially larger than the amounts in Alternatives A, B, and N. Retail space in Mission Bay would be supported by the spending of Project Area residents and workers as well as by spending of people from outside the Project Area. (For more background on the retail conclusions, see pp. VI.B.104-VI.B.106 and VI.B.117-VI.B.119.) With a supermarket in the Project Area, Mission Bay residents would do more of their convenience shopping in the Project Area than assumed for analysis of Alternatives A, B, and N, none of which are likely to provide for a supermarket site. Accounting for that difference and using a similar methodology to that used to analyze Alternatives A, B, and N, it is estimated that spending by Project Area residents and workers would support about 200,000 square feet of retail space in the Project Area under the variant. Given the relatively small amount of Project Area employment under the variant, most of that retail space would be supported by residents' spending. Of the total amount of space, about 300,000 square feet would have to be supported by spending of people from outside the Project Area.

Mission Bay retail space under the variant would have to include attractions drawing from a larger market area. Certainly, the supermarket would offer convenient grocery shopping to residents of Potrero Hill and South of Market neighborhoods. With the variant, it is unlikely that a supermarket or neighborhood shopping center would be developed elsewhere in the vicinity outside Mission Bay. Moreover, for the large amount of retail space to be absorbed, it is likely that the neighborhood commercial street would develop with a high proportion of eating and drinking places and specialty shopping, attracting people to Mission Bay. Developing such a special character takes a long time. Until that happened, there would be somewhat less occupied retail space in Mission Bay than envisioned in the variant.

Another issue related to retail activity in Mission Bay is the effect on neighborhood commercial streets elsewhere in San Francisco. Under the variant, a successful neighborhood commercial street in Mission Bay would compete more with neighborhood shopping streets nearby (e.g., on Potrero Hill or in the Mission District). There would be less sales growth in those areas than otherwise, under Alternatives A, B, and N. As mentioned above, such competition would only develop over the long term. Moreover, the special character and flavor of the older, established districts would continue to attract shoppers, including Mission Bay residents. The large amount of new retail development incorporated in the variant would be likely to have more effect on the potential for other new retail in South Beach, Yerba Buena Gardens, Showplace Square, and other South of Market locations.

On the other hand, Mission Bay development under the variant would contribute to sales growth in other retail districts in the City, primarily as a consequence of the spending attributable to the large number of new Mission Bay residents. As in Alternatives A and B, the people living in Mission Bay would shop for such items as apparel, home furnishings, appliances, and automobiles in shopping areas in San Francisco outside Mission Bay. They also would patronize restaurants and shops along the City's many popular neighborhood streets. The spending attributable to Mission Bay residents in other parts of the City would about offset the spending from people living and working outside the Project Area that would be required to support Mission Bay retail space under the variant.

Implications for Nearby Industrial and Commercial Areas

The overview discussion of the timing and types of effects of Mission Bay development on land use, business activity, and employment in Nearby Areas applies for the variant as well as for the Alternatives (see pp. VI.B.106-VI.B.109). The description of the effects of Alternatives A, B, and N (see pp. VI.B.109-VI.B.117) also is useful background for the following comparative analysis.

South of Market and Other Parts of the Downtown & Vicinity

Mission Bay under the variant would offer no sites for larger-scale office development. Consequently, there would be more new office development and office employment in other office locations such as the South of Market, South Van Ness and the western C-3

District along Market Street than there would under a development program such as Alternative A, which provides for large amounts of new office development in Mission Bay. In this respect, the variant would be somewhat more extreme than Alternatives B and N, each providing one large office site. No new office development in Mission Bay would mean a faster pace of development and change in locations in the Downtown & Vicinity that provide sites for office development. It would be more difficult for older businesses and other rent-sensitive activities to remain in those relatively close-in locations.

Mission Bay under this variant would provide some space to accommodate small service, sales, and office businesses. In this respect it would be more like Alternatives A and N than Alternative B. The ground-floor Service/Commercial space in the variant would provide a location option for rent-sensitive businesses that prefer to be close to the downtown, resulting in less demand overall in the South of Market than would Alternative B. The space also would attract small office businesses that otherwise might compete with existing service, distribution, and light industrial uses for space South of Market.

With ground-floor Service/Commercial and retail use under high-density housing in the blocks along Townsend Street in Mission Bay, the variant would be compatible with the South of Market Plan: Proposal for Adoption. Compared to Alternative A, the variant's lower-intensity commercial development along Townsend Street would be more in keeping with the intent of the South of Market Plan to limit the development of that area as a major office corridor. Compared to Alternative B, with solely residential development along Townsend Street, the variant provides ground-floor commercial activity that would serve as a buffer between the adjacent South of Market commercial district and the Mission Bay residential neighborhood. The mix of uses north of the channel in the variant would provide more support to economic activity South of Market and vice versa than would continuation of the above-ground CalTrain commute station and maintenance operations under Alternative N.

Showplace Square, North Potrero / Potrero Hill, Inner Mission, Lower Potrero / Central Bayfront, and South Bayshore

The implications of the variant for the industrially zoned areas west and south of Mission Bay would be similar to those of Alternative B. The Service/Commercial space in Mission Bay under the variant would not provide the location options for expansion of showroom and related activities and larger-scale service and distribution in the Project Area that could be developed in S/LI/RD space under Alternative A and M-2 Industrial space west of Third Street under Alternative N. The relatively small amount of LI/RD space in the variant would be separated from the Showplace Square and North Potrero areas by the CalTrain station and the freeway and thus would be likely to evolve independent of development trends in those areas. Consequently, as with Alternative B, growth of Showplace Square would be limited to areas west of Mission Bay. Expansion of showroom and related activities in the North Potrero, Potrero Hill, and Inner Mission areas would result in relatively more development activity and change in those areas than expected with Alternatives A or N. Similarly, service and distribution businesses desiring a San Francisco location would look to areas south and west of the Project Area. There also would be demand for space in these areas from older, rent-sensitive businesses that could not compete with the larger-scale office or showroom activities expanding in closer-in locations with the variant.

On the other hand, because of the location options for small office and retail businesses in Mission Bay under the variant, there would be somewhat less conversion and development activity to accommodate that type of demand in the older industrial areas west and south of the Project Area than there would be with Alternative B.

Piers Adjacent to Mission Bay

The land uses proposed for Mission Bay east of Third Street under the variant would not introduce the land use conflicts with active maritime operations on piers adjacent to Mission Bay that would occur under Alternatives A and B. Consequently, as under Alternative N, maritime-related activity could continue longer on the piers adjacent to Mission Bay. Similarly, as described above in the discussion of maritime activity in the Project Area, the variant would reserve land east of Third Street under the Port-Related designation for eventual development of a container terminal facility adjacent to Mission Bay.

The variant would introduce an obstacle to more intensive maritime activity or container terminal development that would not be present under Alternative N, however. Over time, the large wetlands and recreational open space east of Third Street, in combination with mixed-use development west of Third Street, could raise political barriers to more intensive maritime development near Mission Bay.

Implications for Citywide and Regional Growth and Development Patterns

The rationale for determining how the various options for Mission Bay development would affect development patterns and the amount of employment growth in San Francisco and other parts of the region is described on pp. VI.B.119–VI.B.121. For this aspect of the analysis, the consequences of the variant would be similar to those of Alternative B (see p. VI.B.122). Total Mission Bay employment would be lowest with either the variant or Alternative B, resulting in less employment growth in the City and more employment growth and development dispersed to different locations throughout the region, compared to Alternatives A and N.

Because the variant, unlike Alternatives A, B, and N, does not incorporate a large office complex, there would be less total potential in San Francisco for the back-office and government activities that seek lower-rent office space with large floor-plates. There would be somewhat more office development in locations that compete with San Francisco, such as downtown Oakland and eastern Alameda and Contra Costa Counties.

HOUSING AND POPULATION

Implications for Households and Population in the Project Area

By build-out, Mission Bay under the variant would have 8,500 new housing units and about 16,700 residents. The variant would accommodate more housing units and more population than Alternatives A and N, and less housing and population than Alternative B.

As in Alternatives A and B, new residential development in Mission Bay under the variant would provide a mix of types and sizes of new units and would accommodate a mix of different households and people. The general description for Alternatives A and B on pp. VI.C.64–VI.C.65 would apply for the variant as well.

There would be some differences in the types of new housing provided in Mission Bay under the variant. One difference would be that a larger percentage of the new units would be affordable: 50% compared to 30% for Alternatives A and B. Another difference would arise because the mix of housing among density categories would include proportionally more higher and lower density units. Differences in density would result in proportionally more larger and smaller units and proportionally fewer average size units in Mission Bay under the variant, although the overall average space per unit is assumed to be similar to that for Alternatives A and B (averaging 850 square feet per unit overall).

As a result of differences in the characteristics of the housing built under the variant, there would be differences in the characteristics of households and population in the Project Area. Average household size in Mission Bay would be larger than that under

Alternatives A and B, reflecting proportionally more families with children. Although there would be more workers per houshold, on average, employed residents would represent a smaller percentage of Project Area population. There also would be differences in household incomes. As a result of the higher percentage of affordable housing, households in Mission Bay would have lower average incomes under the variant as compared to Alternatives A and B.

Like Alternatives A, B, and N, the variant would include the houseboat community. Under the variant, Mission Bay also would include 200 live/work units that would not be built in the Project Area under the Alternatives. (The 200 live/work units are included in the total of 8,500 new housing units discussed above.)

Implications for Nearby Residential Areas

The implications of Mission Bay development under the variant for nearby residential neighborhoods would be similar to those of Alternatives A and B (see pp. VI.C.86-VI.C.92). As with those Alternatives, a strong direction for the types of changes attributable to Mission Bay development is difficult to predict, since the various features of the variant would have offsetting implications.

Since the variant would represent an upgrading of the urban environment in that sector of the City, it could potentially contribute to increased demand for housing in those older residential neighborhoods in the vicinity. On the other hand, the variant would add a large amount of housing to the City's stock, absorbing some of the demand for housing that otherwise would contribute to gentrification in nearby neighborhoods.

For residents of nearby neighborhoods, the variant would provide more in the way of community services, cultural, recreational, and open space resources, and retail shopping opportunities than would Alternatives A, B, and N. Some of the amenities also would serve as citywide resources.

Project Area Jobs/Housing Relationship and Implications for the City's Housing Market

Relationship Between Project Area Employment Growth and Housing Development

The City's OAHPP requirements relating housing production to the development of office space would not apply under the variant since it does not include office development as a future land use in the Project Area./10/

As with Alternatives A and B, the number of housing units built in the Project Area would exceed the number of units needed in San Francisco to accommodate Project Area employment growth. The estimated number of units to accommodate additional San Francisco households with Project Area workers (about 860) would represent about 10% of the number of new housing units built under the variant (8,500)./11/ The remainder would represent housing available to accommodate other demand besides that associated with Mission Bay employment growth, thus improving the City's ability to accommodate other households looking for housing in San Francisco.

The additional San Francisco households under the variant would require about 745 housing units in the affordable category./11/ Those units would represent about 9% of new Mission Bay housing, a much lower percentage than the 50% assumed to be priced at affordable levels. However, some households with Project Area workers would have incomes below the levels needed to pay the affordable new housing prices assuming prices similar to those for affordable housing in Alternatives A and B.

For comparison, the jobs/housing analysis for Alternatives A, B, and N is presented in text and tables on pp. VI.C.70-VI.C.77.

Comparison with the Alternatives and Implications for Citywide Housing Market Conditions

Compared to Alternatives A, B, and N, the variant would accommodate a relatively large amount of new housing, would add the largest number of affordable housing units, and would accommodate a relatively small amount of employment growth in the Project Area. The variant would be most similar to Alternative B in its effects on the City's housing market. (See pp. VI.C.81-VI.C.86 for general discussion of the implications for citywide housing market conditions.)

Compared to Alternative B, the variant would accommodate a similar amount of employment growth, would add less market-rate housing (2,750 fewer units) and less total housing (1,500 fewer units) in the Project Area, but would add more affordable housing (1,250 more units). The large amount of housing in Mission Bay would expand the City's housing stock across a range of prices and rents, thereby relieving demand pressures that otherwise would exist. The new housing would accommodate households that otherwise would compete for existing housing. Of particular benefit to the market would be the addition of affordable housing since such units are difficult to produce in San Francisco and will remain in strong demand in the future.

Compared to Alternative B, the variant is likely to be more beneficial to those in the market for affordable housing (units priced just below that required for market-rate housing), while Alternative B would provide more benefit in the middle range of the market (housing priced at or just above the threshold price required to develop market-rate housing).

Implications for the Housing Market in the Rest of the Region

Mission Bay under the variant, and the citywide cumulative context of which it would be a part, would contribute to regional housing market conditions in the future. The effects of the variant would be similar to those with Alternative B (see pp. VI.C.92-VI.C.97).

Regional housing market conditions are not expected to differ substantially as a result of the choice of a development program for Mission Bay. The development program for Mission Bay would influence the source and location of housing demand in the region but would have little effect on the total magnitude of regional housing demand and on overall regional housing market conditions.

COMMUNITY SERVICES, CULTURAL FACILITIES, AND INFRASTRUCTURE

Space for a wider variety of community and cultural facilities would be provided by the variant than by Alternatives A and B. Community and cultural facilities in the variant would include publicly owned uses similar to those defined as community facilities in Alternatives A and B, as well as privately owned facilities such as theaters, child care centers, and art galleries. Community facilities in the variant could include a library, senior center, health center, recycling center, school, and fire and police facilities.

Fire Protection

In 2020, about 8% more fire/non-fire incidents would be expected under the variant than in Alternative B, which has the highest number of incidents among the EIR Alternatives./12/ As in Alternatives A and B, both an engine company and truck company, with accompanying personnel, would have to be added to maintain adequate levels of service in Mission Bay and the surrounding areas. As in Alternative A, renovation and expansion of closed Fire Station 30 could accommodate required firefighting equipment and personnel. As in the Alternatives, the existing high-pressure water system would need to be upgraded to serve the interior portion of the Project Area adequately.

Police Protection

By 2020, the number of police incidents would be about 13% lower than the number of incidents in Alternative A and about 16% lower than the number of incidents in Alternative B due to the different mix of land uses (i.e., less office space development than that in Alternative A and a smaller residential population than that in Alternative B)./13/ The wetlands area could provide a gathering place for transients. As in Alternatives A and B, the need for additional police personnel could not be accommodated in existing police stations. Personnel, equipment, and space requirements would be about the same as those in Alternatives A and B.

Public Schools

The variant would have a greater impact on SFUSD enrollment than would any of the Alternatives. Approximately 2,000 SFUSD students are projected to live in the Project Area under the variant in the year 2020, about 38% more than the number of students under Alternative A and about 7% more than the number of students under Alternative B. As in Alternatives A and B, existing schools in the adjacent Nearby Areas and the district as a whole would not have sufficient space to accommodate these students. Project Area students would require about 34 elementary classrooms, 17 middle-school classrooms and 23 high-school classrooms (representing about two elementary schools, about one-half of a middle school, and about one-third of a high school). About 120 teachers/staff members would be needed. If developed for an elementary school, the 1.9-acre area northeast of Owens Street could accommodate 460 elementary students, about 23% of the total number of students projected to live in the Project Area.

Parks and Open Space

Figure VII.8, p. VII.58, shows the open space network for the variant. Open space provided encompasses the following two major areas and several smaller parcels:

- Mission Bay Park: A 36.5-acre area between Third Street and China Basin Street, north of 16th Street. The area includes a wetlands in the center and separate areas for active recreation and a community garden. A recycling center would occupy the southwest corner.
- Mission Creek Park: A 38-acre area along the north and south sides of China Basin Channel connecting to a larger open space area west of the channel bounded by Townsend and Seventh Streets, providing active and passive recreational opportunities.

- Neighborhood Parks: 17.9 acres of smaller neighborhood parks and open space areas scattered throughout the Project Area.

The variant would provide 92.4 acres of open space, including the 20-acre wetland and 12-acre China Basin Channel, an amount similar to that provided in Alternative B (94.1 acres). The variant could pose some land use compatability problems (e.g., noise) between port-related industrial uses and wetland/recreational uses south of the port area. If a container terminal were developed in the future, it would likely pose a potentially greater land use conflict than smaller-scale maritime activity. Active recreation activities surrounding the wetlands area also pose compatability issues. A minimum 100-foot buffer zone would be needed to separate wetland marsh from other recreation activities within the open space park.

The variant would respond to applicable open space policies with the exception of Policy 1 of the Recreation and Open Space Element, which calls for the City to increase the per capita supply of open space to the extent it reasonably can above the current ratio of about 5.5 acres per 1,000 population. With about 80.4 acres of open space provided, excluding the 12-acre China Basin Channel, the variant would provide about 4.8 acres per 1,000 population (as compared to 3.0 acres per 1,000 population in Alternative A and 4.4 acres per 1,000 population in Alternative B). As with Alternatives A and B, the variant would not meet National Recreation and Park Association (NRPA) standards of five acres per 1,000 residents for neighborhood-serving and district-serving open space./14/ Park personnel requirements would be similar to those of Alternative B (40 persons).

Other Facilities and Services

By the year 2020, Mission Bay residents, employees, and businesses would generate about the same water demand as Alternative B. As in Alternative B, the variant may require relocating the existing 12-inch line east of China Basin Street for construction of the wetlands south of Pier 54.

By the year 2020, wastewater generated by Mission Bay residents, employees and businesses would be approximately 18% less than that for Alternative A and 7% less than that for Alternative B. This would not affect the City's current treatment or collection capacity.

Under the variant, a parcel west of Third Street has been identified for a library/community center. As with Alternatives A and B, Project Area and nearby population levels would not meet San Francisco Library criteria for a new branch library (see p. VI.D.92).

Impacts on other community services would be similar to impacts in Alternatives A and B.

TRANSPORTATION

Estimated travel demand generation for the analysis, as for the Alternatives, is based on the number of employees and employed residents estimated for the Project Area. While the types of jobs differ between this variant and Alternative B (specifically, no office buildings in this variant), assessment of cumulative travel demand generated by this variant (relative to Alternative B) indicates that differences in cumulative transportation impacts would not be significant.

The variant would have about 1,935 fewer residents (and 1,450 fewer employed residents) than would Alternative B, resulting in about 13% less p.m. peak travel demand entering the Project Area compared to Alternative B. Because there would be about 490 more employees projected for this variant compared to Alternative B, there would be about 8% more p.m. peak travel demand leaving Mission Bay.

The net result for total p.m. peak-period travel demand generated by this variant would be about 9% below that forecast for the Project Area for Alternative B and would not significantly change projections of either cumulative screenline travel demand or intersection levels of service./15/ Fewer housing units within the Project Area compared to Alternative B, however, would mean fewer opportunities for downtown employees to live in the Downtown & Vicinity, thus increasing cumulative commute trips that would cross MUNI or regional screenlines.

The placement of Port-Related/M-2 uses east of Third Street, 680,000 square feet of Service/Commercial uses along Third, Fourth and Townsend Streets and, to a lesser extent, of 500,000 square feet of retail space chiefly on Long Bridge Street would shift Mission Bay employment, relative to Alternative B, from the west side of the Project Area (on Owens Street) to the east and north sides. These changes would result in more p.m. peak-period traffic flows away from the Project Area along Third and Fourth Streets, but fewer housing units would result in less p.m. peak-period traffic into the Project Area. Project Area intersections forecast to be congested, operating at Level of Service (LOS) D or E in 2020, however, would not be expected to be further degraded from levels of service projected for Alternative B (see Table VI.E.26, p. VI.E.168).

Off-peak travel demand within the Project Area associated with Service/Commercial and retail uses would be higher under this variant than under the Alternatives (see also the Transportation discussion in Variant 4 on pp. VII.28-VII.29), although many of these trips would be expected to be by pedestrian and transit travel.

Parking supply rates and demand ratios used for the variant are the same as those used for Alternative B. Service/Commercial uses under this variant would supply one off-street parking space per 1,000 square feet of floor area (used for office, S/LI/RD, and retail uses for Alternatives A and B) and would generate a parking demand of 1.46 spaces per 1,000 square feet of floor area. The proposed development in this variant would provide approximately 11,130 off-street spaces. An estimated parking demand of about 12,145 spaces for this variant would result in a parking deficit for the Project Area of about 485 spaces./16/

Peak parking demand associated with a 400-seat and two 200-seat theaters (cultural facilities) would be expected to occur primarily on weekday evenings and weekends, when there could be available parking off-street as well as on-street. To the extent off-street spaces were not accessible, on-street spaces on blocks with ground-floor retail or Service/Commercial uses would potentially be available. An estimated 95 and 130 on-street spaces on such blocks would be within a reasonable 1,500-foot walking distance of the 200-seat theaters at King and Fourth Streets, and 16th and Long Bridge Streets, respectively. About 185 on-street spaces would be within walking distance of the 400-seat theater proposed to be in the center of the housing units south of China Basin Channel. Because those spaces could also be in demand for other competing uses, it is likely that parking demand from those cultural facilities would generate impacts on adjacent residential blocks. The proximity of MUNI transit lines to these theaters, however, would also decrease some of this potential parking demand.

Parking impacts could also be associated with open space and recreational facilities, and would depend on the type of activity occurring there. The plan for this variant shows provision of off-street parking only for the wetlands park and adjacent sports facilities east of Third Street. Peak parking demand related to these uses would most likely occur on weekday evenings or on weekends, when there could be available parking off-street as well as on-street, although some spillover parking demand could occur in adjacent residential areas. Mitigation measures to reduce parking impacts for Alternative B (described in VI.E Transportation, pp. VI.E.207-VI.E.209 and pp. VI.E.222-VI.E.223) would apply to this variant as well.

Freight loading and service vehicles connected with Service/Commercial uses on Third and Fourth Streets would generate more truck traffic and demand for off-street loading spaces on these major north-south thoroughfares. The Transportation Element of the Master Plan identifies both of these streets as Transit Preferential Streets. The Planning Code (Section 155) discourages access to loading from streets so designated to reduce conflicts with transit vehicles. Truck loading access south of the channel, however, could be provided from alleys parallel to Third Street to minimize this impact.

The proposed 400-room hotel, fronting on Third Street just south of China Basin Channel, is not part of Alternative B. Compared to the hotel in Alternative A, this site is much smaller in area and access is restricted to only one major street. Its location precludes access for loading and service vehicles from any street other than Third Street. Circulation of taxis and airport shuttle vans accessing the hotel could also affect traffic flow conditions on Third Street.

The variant proposes CalTrain run underground from just south of the China Basin Channel to an underground station to be built under King Street between Third and Fourth Streets. King Street, rather than the current Townsend Street, would be the site of the underground station, as that location is compatible with convenient passenger transfer from a stop on the proposed MUNI Metro line on King Street. From the King Street station, CalTrain could be extended downtown at some future time, subject to decisions and actions by the Peninsula Corridor Study Joint Powers Board. Variant 9, CalTrain Station Location (Alternatives A and B), pp. VII.51-VII.54, discusses the impacts of retaining the CalTrain terminal generally at its current site, i.e., not relocating the terminal to Seventh and Channel Streets. Some of those findings would be similar for this variant, as follows:

- CalTrain's future ridership could be up to about 22% higher, and ridership on BART (West Bay) and SamTrans could be about 9% and 11% lower, respectively, than the cumulative forecasts for the South Bay screenline for Alternative B. Levels of service would be at LOS C or better on these transit modes, with no significant differences projected from forecasts for Alternative B.

- Vehicle volumes on Highway 101 and I-280 at the South Bay screenline would be about 5% less than the volumes presented for Alternative B. For U.S. 101, this would not result in any substantial change in the duration of congestion (about three hours in 2000, over three hours in 2020) or operating LOS during the p.m. commute period.

- MUNI bus routes which would continue to serve the CalTrain Station at Fourth and King Streets might not be extended to Seventh and Channel Streets, but could be extended past Fourth and King Streets through the Project Area on different alignments.

- The peak pedestrian concentration would not be at Seventh and Channel Streets, but would remain near where it is now with pedestrian travel flows to and from downtown north of Third, Fourth and King Streets.

MUNI's 1987–1992 Short Range Transit Plan calls for extension of Metro service via a reconstructed roadway on The Embarcadero and King Street to the CalTrain terminal at Fourth and Townsend Streets. Further extension of service through the Project Area would be the subject of negotiations for the development agreement for Mission Bay. This variant would extend MUNI Metro past the CalTrain station to Seventh and Channel Streets near the proposed MUNI yard. MUNI's long-range plan is to extend Metro service to the south to serve the Bayshore Corridor. The implications of extending MUNI Metro into Mission Bay on this long-range plan are discussed on pp. VI.E.196–VI.E.197.

Although specifics, such as the number of lanes on Project Area roads, have not been defined, the roadway network under the variant would generally share the freeway and street characteristics of the three Alternatives. As with the Alternatives, alignment of all streets in the Project Area north of China Basin Channel would follow the existing South of Market grid. South of the channel, the street grid would follow a mixed grid (South of Market grid generally west of, and the Third Street grid east of, Long Bridge Street).

Differences include expanded access between the Project Area south of China Basin Channel and existing neighborhoods to the west via a connector street from Owens Street to Seventh Street near Hooper Street. CalTrain tracks would be underground at this location. This would have the effect of diverting some traffic that would otherwise use 16th Street across Seventh Street. Although diversion would occur throughout the day, the greatest diversion would occur during the p.m. peak period primarily because of delays from increased CalTrain operations across 16th Street to/from its terminal during this period. Drivers could use Hooper Street to avoid the downed railroad crossing gates. Congestion would be reduced at the intersection of Seventh and 16th / Mississippi Streets, and the p.m. peak-hour level of service could be improved by up to one service level.

AIR QUALITY

As with Alternatives A, B, and N, motor vehicle exhaust emissions would be the primary source of pollutants with this variant. Vehicle miles traveled, and therefore air emissions, in the variant would be about the same as those in Alternative B./17/

As in Alternative B, emissions of carbon monoxide, hydrocarbons, and nitrogen oxides from vehicle trips generated by the variant would exceed 1% of county-wide emissions of those pollutants, and thus would be considered potentially significant by the Bay Area Air Quality Management District. Roadside carbon monoxide concentrations in the vicinity are expected to be within state and federal standards. As in the Alternatives, although the variant would be consistent with 1982 Bay Area Air Quality Plan strategies encouraging development in established areas, the land use and population projections for the variant exceed those on which the plan was based.

NOISE

The effects of the local noise environment on the variant, and the variant's effects on the local noise environment, would be similar to those of Alternative B. Noise from port-related uses near the wetlands could affect wildlife. With the undergrounding of CalTrain and the removal of the existing CalTrain station, noise impacts from CalTrain would be reduced. As with Alternatives A, B, and N, future noise levels in the Project Area with the variant would noticeably increase over existing noise levels due mainly to increased traffic.

ENERGY

Energy consumed in construction of the project and project-related transportation would be about the same as that in Alternative B. Total operational energy consumption by buildings under the variant would be about 4% lower than the amount under Alternative B.

ARCHITECTURAL RESOURCES AND URBAN DESIGN

As with Alternative A, the variant would retain architecturally interesting Fire Station 30 (at the intersection of Third, Fourth and Mission Rock Streets) for community facilities. The character and scale of development under this variant would be generally similar to, but more uniform than, the character and scale of development under Alternative B. As with Alternatives A and B, the variant would represent a change from predominantly low-rise, industrial buildings to mixed-use neighborhoods. The scale of development in the variant would generally increase toward the north, varying from townhouses and flats at the southern end of Mission Bay to eight-story HDR buildings north of China Basin Channel. Effects of the variant on long-range and street-level views would be similar to effects under Alternative B.

East of Third Street, the variant would differ from Alternatives A and B by providing generally low- to mid-rise Port-Related / M-2 uses west of Piers 48 to 50 and a wetlands park south to 16th Street. Alternatives A and B generally have residential, open space, and S/LI/RD uses east of Third Street.

CULTURAL RESOURCES

As in Alternatives A and B, development under the variant would take place in areas that could contain subsurface artifacts (see Figure VI.J.1, p. VI.J.17). Potential impacts would be similar to those under Alternatives A and B, although excavation required to underground CalTrain could increase the potential to disturb cultural resource areas.

GEOLOGY AND SEISMICITY

Similar to Alternatives A and B, the variant involves development of housing and commercial uses in a seismically active region, and in an area of San Francisco susceptible to earthquake hazards. Casualties in the Project Area from a daytime earthquake (2:00 p.m.) would be about the same as casualties in Alternative B, as the daytime population (employees, unemployed residents, and 40% of hotel guests) would be about the same.

VEGETATION AND WILDLIFE, AND WETLANDS HYDROLOGY

Mission Creek Park

Approximately 18 acres of Mission Creek Park surrounding China Basin Channel would be north of the channel. There also would be approximately four acres of small park-like public open spaces adjacent to residential buildings. As with Alternative B, the channel would not be dredged. The north edge would be gabions, riprap, or similar edge treatments along the channel. The linear open space parallel to the channel would have a high level of human activity. Other wildlife species that might benefit from the park as an increase in habitat would be animals that are not sensitive to human activity. The species using the area would be similar to those expected to use the park-like open space along the channel in Alternatives A and B.

Approximately nine acres of Mission Creek Park would be along the south bank of China Basin Channel. About 300 feet of the channel bank would be changed and the remainder left in its existing condition. As with Alternative A, increased human activity in the vicinity could substantially reduce or eliminate heron and egret use of the shoreline.

Some birds may continue to rest on the banks and on piers and pilings and to fish and hunt along the south bank. The bank could be improved for animal use by reducing the elevation of the fill in the park area to broaden the zone in which marsh plants will grow. Pickleweed would spread readily and plants such as jaumea, salt grass, gum weed, and salt marsh lavender could be planted. Ducks and other water birds may use the widened bank as a resting area.

Small Parks

South of Mission Creek Park, neighborhood areas of park-like open space are proposed. This open space would receive a high level of human activity and provide habitat only for those species of wildlife which are not sensitive to human presence. Animals and birds expected to use these areas are the same as those expected in the high-activity open space north of the channel.

Mission Bay Park

A 20-acre tidal wetland would be developed in the central portion of a 36-acre park east of Third Street between Piers 50 and 64. Under this variant, a low, ruined wooden pier to the south of Pier 54 would be removed. The wetland would be created by excavating the portion to be exposed to tidal service and connecting this to the Bay just south of Pier 54 by means of a breach under China Basin Street. The upland portions of the park would contain active recreational uses.

Wetlands

Berms would be placed between the high-activity areas of the park and the tidal marsh area. These berms would act as sound barriers and also screen the visual impact of human activity from sensitive species in the marsh. The crest of the berms and hills would also create viewing positions for marsh visitors to sit on, but active sports such as frisbee throwing should be discouraged. This may be done by placing large rocks on the knolls so that they give an appearance of rock out-croppings. Around these rocks, native upland shrubs, trees, and grasses may be planted. The tidal marsh and buffer area should be hard edged or fenced to prevent wildlife disturbance by human and domestic animal intrusion. To protect wildlife from disturbance, signs should be posted on the park side of berms and hills to indicate that users should avoid active sports, such as jogging, in sight of the marsh. The topographic relief would serve to divert surface runoff away from the tidal wetland and into City storm sewers. This would help to prevent the addition of non-point source pollutants such as fertilizers to the wetland ecosystem. It would also serve to protect the surrounding areas in the event that mean sea level (MSL or National Geodetic Vertical Datum [NGVD] 0.0) increases due to the greenhouse effect (see Volume Four, XV.J. Hydrology and Water Quality, pp. XV.J.3-XV.J.5)./18/

If 20 acres are devoted to wetland, it may be difficult to fit in all of the other active uses in the remaining 15 acres; the narrowest "buffer" zone acceptable to the U.S. Fish & Wildlife Service and the California Department of Fish and Game between human activity (the path) and the wetland is 100 feet./19,20/ A special study prepared by Wetland Research Associates for the City suggested a 100-foot buffer zone between the edge of the wetland and the higher-use upland area, and 150 to 200 feet between public areas and mudflat areas./21/

Wetlands Hydrology

The tidal range within the wetland would be approximately five feet or 83% of the tidal fluctuation in San Francisco Bay, were the wetland designed as follows: a total wetland surface of 17 acres; a shallow, 100-foot-wide perimeter area; average depths of 10 feet in channel and main body of the wetland; a 50-foot trapezoidal breach that is 200 feet in length; and tidal ranges that average six feet on the Bay side of the breach. The wetland would hold about 4.6 million cubic feet of water when the tide is at mean sea level, and with each tidal cycle it would exchange 1.3 million cubic feet. The peak velocities in the channel would be 0.8 foot per second and could be as high as 1.0 to 1.2 feet per second but are not expected to cause scour at these velocities.

It is estimated that 415 cubic feet of groundwater would seep into the wetland during each tidal cycle and since there is a tidal exchange of 1.3 million cubic feet, there would be a dilution factor for infiltering groundwater of 3100:1. The existing piers (e.g., Pier 54) would not interfere with dilution and mixing of the water and thus would not affect water quality. The pilings may provide protection from storm winds and waves which approach the site from the northeast. The main impact of the continuing presence of Pier 54 is visual: visitors to the park would not be able to see as much of San Francisco Bay.

In conclusion, there appear to be no major obstacles to prevent the wetland from functioning adequately from a hydraulic standpoint although, as with the wetlands in Alternative B, more design work must be done before the relative feasibility of the wetland is firmly established. The design must consider: 1) the properties of the fill and Bay Muds at the site; 2) the hydrogeologic and geotechnical feasibility of dry dredging the wetlands /22/; 3) basic hydrogeologic and water quality data on the role of groundwater inflow on the new wetland and the benthic organisms and wildlife which inhabit it; and 4) specification refinements to enable hydraulic and sediment accretion studies to be carried out on the connecting channel and channel mouth./23/ (Refer to Mitigation Measures M.6 and M.7 on p. VI.M.23, M.14 and M.15 on p. VI.M.25, and N.1, N.2 and N.3 on pp. VI.N.39-VI.N.43.)

As with wetlands in Alternative B, actions with reference to the quality of the soil and groundwater might be as follows: 1) test soils for hazardous materials and map concentrations of materials/debris; 2) make decisions about feasibility of site and method of approach; 3) if feasible to continue, place sheet pile wall or dam along China Basin Street to exclude tidal water; 4) if necessary, enclose proposed tidal marsh area with an "invisible barrier." This barrier may be a slurry dam, or a sheet pile or concrete wall located under the path location and continuous around the marsh from ground level to approximately -15 or -20 feet NGVD (-23 or -28.6 feet San Francisco City Datum).

Wetlands vegetation and wildlife would be subject to approximately the same conditions as in Alternative B. Net benefit of the variant lies in the larger contiguous acreage requiring a smaller percent of total acreage for perimeter (i.e., buffer zone, wall, high marsh). For example, 20 acres in a square or rectangular parcel would allow for almost 16 acres of habitat if developed with a 100-foot-wide buffer around the perimeter. Were the same 20 acres subdivided into three parcels, the useable acreage would be reduced by 17% to 13.2 acres.

HAZARDOUS WASTES

Surface soil, subsurface soil, and groundwater at Mission Bay could potentially be contaminated with hazardous wastes. Overall impacts would be similar to those in Alternatives A and B. However, undergrounding of CalTrain from 16th Street to the proposed underground terminal would require considerable excavation, with increased opportunities to encounter potential hazardous waste deposits. The CalTrain right-of-way passes through portions of Mission Bay that have been used by chemical industries, oil storage and processing facilities, and rail trackage.

If the Mission Bay Hazards Mitigation Program were to apply to the variant as it would to Alternatives A and B, portions of the Project Area proposed for development in the variant and appropriate buffer zones would be investigated, and any necessary clean-up would be completed before work in each development phase area began.

GROWTH INDUCEMENT

Generally, the growth inducement effects of the variant would be similar to those of Alternative B. (See pp. VI.O.1–VI.O.9 for description of relevant growth inducement issues and comparison of Alternatives A, B, and N.) Most of the growth inducement issues (net addition to citywide employment and population, regional development patterns, and spillover effects in Nearby Areas) are discussed in the Land Use, Business Activity, and Employment section and the Housing and Population section of this analysis of the variant. Regional growth inducement issues and multiplier effects are summarized below.

As with Alternative B, the variant would result in more induced growth and impacts dispersed throughout the region and less total growth in San Francisco, compared to Alternatives A and N. That is because some of the business growth (particularly office activity) not accommodated in Mission Bay under the variant would instead locate in other parts of the region outside San Francisco.

As with the Alternatives, economic activity in Mission Bay under the variant would support and would be supported by economic activity elsewhere in the City and the region. Those economic inter-relationships are identified as multiplier effects. The magnitude of multiplier effects associated with the variant would be similar to the situation with Alternative B. Both would generate a smaller amount than either Alternative A or Alternative N.

MITIGATION

Mitigation measures for Alternative B (see Mitigation sections in Chapter VI. Environmental Setting, Impact and Mitigation) would apply to this variant, with the following additions to Measure M.5, in VI.M. Vegetation and Wildlife, p. VI.M.22, that pertain to wetlands. (New Mitigation Measures M.5f and M.5g, shown in VI.M. Vegetation and Wildlife on p. VI.M.23, would apply to Variant 11 also.)

The wetland east of Third Street would enhance the marginal wetland area currently located along the banks of China Basin Channel, as well as provide expanded wetland habitat opportunities in the Project Area.

The design of the wetland should include the measures identified below:

- Level the design slope between the elevations of 2.5 and 3.5 feet NGVD (-6.1 and -5.1 feet San Francisco City Datum) to maximize the pickleweed zone or marsh plain within the wetland. Secondly, level design slope between -2.5 and +1 feet NGVD (-11.1 and -7.6 feet San Francisco City Datum) to maximize the area serving as mudflat habitat for invertebrates. (For Variant 11, this would replace Measure M.9, p. VI.M.24.)

- Grade three islands to the elevation of 2.5 to 3.5 feet NGVD (see paragraph above). Provide small areas of refuge that reach an elevation of +6 feet NGVD (-2.6 feet San Francisco City Datum). Grade two islands to an elevation of +6 feet NGVD. That would provide protected nest sites for birds and a refuge from high tides for small mammals. (For Variant 11, this would replace Measure M.10, p. VI.M.24.)

• 12. DEVELOPMENT AGREEMENT APPLICATION (ALTERNATIVE A)

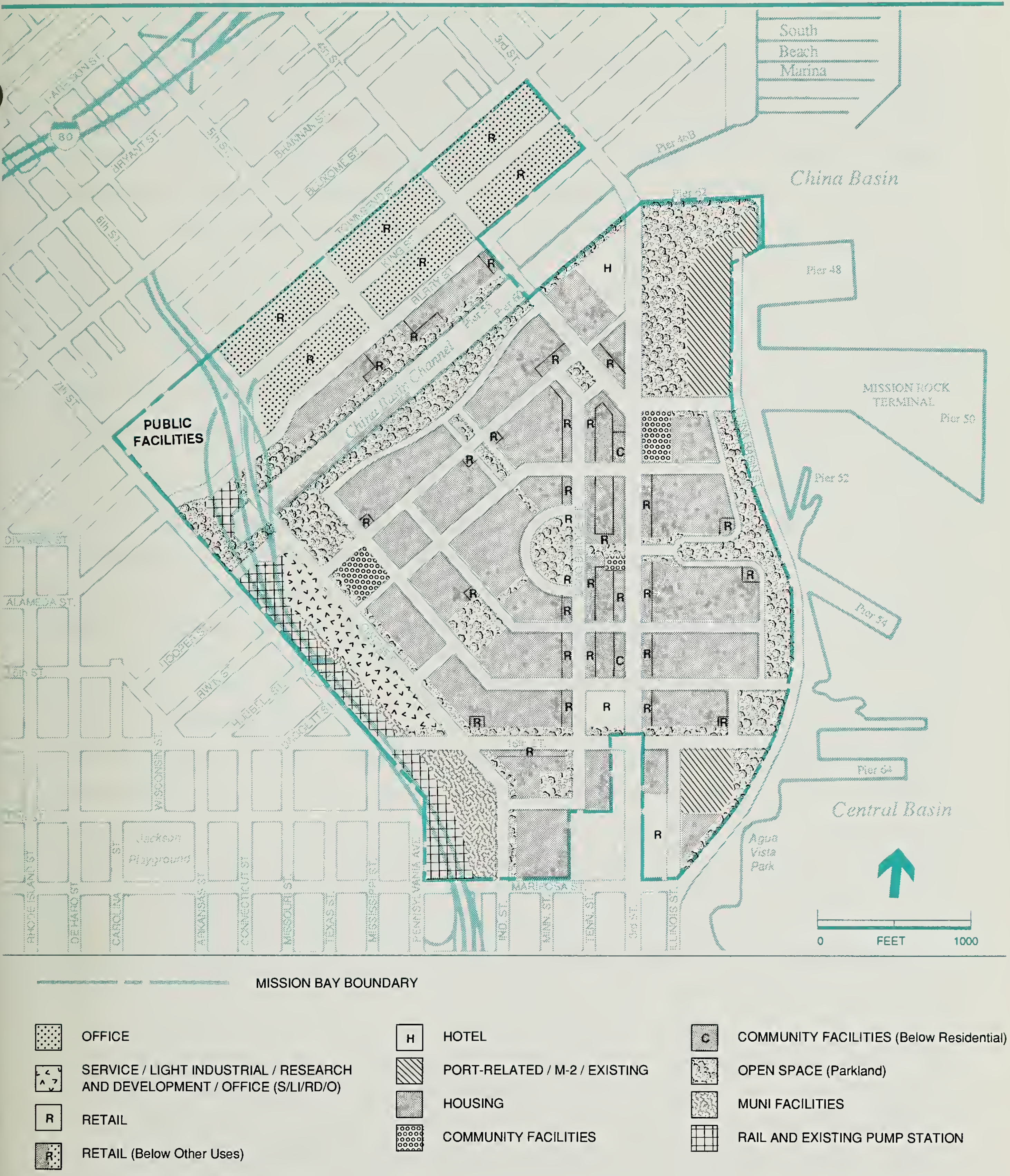
DESCRIPTION

This variant represents the development agreement application submitted by Santa Fe Pacific Realty Corporation (SFP) on May 1, 1989, currently under negotiation between the City and project sponsor. The variant's land use plan is shown in Figure VII.9.

The variant is most closely related to Alternative A. It includes less total commercial space and more residential units than Alternative A. It would provide about the same number of jobs as Alternative A, with a higher percentage of jobs in office and retail activities and a lower percentage in S/LI/RD activities. The variant would provide 300 more housing units than Alternative A (about 4% more) and would accommodate about 14% more residents. About 37.5% of the housing units would be "affordable," as compared to 30% in Alternatives A and B. The variant would provide approximately 14% more open space than would Alternative A.

As in Alternative A, office uses would be concentrated north of Berry Street. The variant would include about 700,000 square feet (17%) more office space than Alternative A. A new use, Service / Light Industrial / Research and Development / Office (S/LI/RD/O), would be located near the southwestern edge of the Project Area, near I-280. That use would be similar to S/LI/RD proposed in Alternatives A and B, but could include office uses as well (see Variant 7, pp. VII.41-VII.47, for information on allowing office uses in S/LI/RD in Alternative A). The variant would provide only about 25% of the S/LI/RD-type space contained in Alternative A. A 500-room hotel would occupy the northeastern corner of the "banana triangle" along Third Street, south of China Basin Channel.

The variant includes three times as much retail space as Alternative A (see also Variant 4, pp. VII.24-VII.32, for information on increased retail space in Alternative A). Most of the retail space in the variant would be ground floor shops, stores, and eating and drinking


South Beach Marina
China Basin
Pier 46B
Pier 48
Pier 50
MISSION ROCK TERMINAL
Pier 52
Pier 54
Pier 64
Central Basin
Agua Vista Park
China Basin Channel
PUBLIC FACILITIES
80
HARRISON ST.
BRYANT ST.
BRANNAN ST.
BLUXOME ST.
TOWNSEND ST.
KING ST.
BERRY ST.
3rd ST.
4th ST.
5th ST.
6th ST.
7th ST.
DIVISION ST.
ALAMEDA ST.
15th ST.
16th ST.
17th ST.
HOOPER ST.
IRWIN ST.
HUBBELL ST.
CROCKETT ST.
WISCONSIN ST.
RHODE ISLAND ST.
DE HARO ST.
CAROLINA ST.
ARKANSAS ST.
CONNECTICUT ST.
MISSOURI ST.
TEXAS ST.
MISSISSIPPI ST.
PENNSYLVANIA AVE.
IND. ST.
MINN. ST.
TENN. ST.
3rd ST.
ILLINOIS ST.
MARIPOSA ST.
Jackson Playground
H
R
C
0
FEET
1000
MISSION BAY BOUNDARY
OFFICE
SERVICE / LIGHT INDUSTRIAL / RESEARCH AND DEVELOPMENT / OFFICE (S/LI/RD/O)
R RETAIL
R RETAIL (Below Other Uses)
H HOTEL
PORT-RELATED / M-2 / EXISTING
HOUSING
COMMUNITY FACILITIES
C COMMUNITY FACILITIES (Below Residential)
OPEN SPACE (Parkland)
MUNI FACILITIES
RAIL AND EXISTING PUMP STATION

Mission Bay

SOURCE: Environmental Science Associates, Inc.

• FIGURE VII.9
DEVELOPMENT AGREEMENT APPLICATION (ALTERNATIVE A)

places as found along a typical neighborhood commercial street; second-story commercial space could locate along Third Street, south of the channel. North of the channel, there would be ground-floor retail space to serve Mission Bay office workers and South of Market workers. There would be two sites for larger-scale retail stores, located in the southern part of the Project Area near the intersection of Third and 16th Streets. One of those sites would be developed with a supermarket and other convenience stores.

The variant would include more open space than Alternative A (62.8 acres of open space compared to 55.3 acres in Alternative A), but less open space than Alternative B (with 94.1 acres). There would be three active open space areas (south of the channel and immediately east of I-280, east of Third Street and south of the extension of Pier 48, and northeast of Esprit), as well as passive open space parks and paths. The variant would not include wetlands.

The variant would preclude development of a container terminal adjacent to Mission Bay, as would Alternatives A and B. About six acres of land would be available for port-related uses adjacent to Piers 48 and 50. That backland would facilitate the continued use of those piers as non-container terminals and for other maritime-related activity.

The northwest corner of the Project Area is designated for "Public Facilities." That site could be used for public parking structures, community services, parks, museums, libraries, schools, etc. or assembly and entertainment uses such as theaters or an arena. In this variant, the public facilities site is assumed to be occupied by a mix of uses with a generally daytime pattern of use and an average employment density about the same as that for community facilities. Were the site to be occupied by an arena, impacts would differ. An arena on that site is considered in a supplement to the Mission Bay EIR, published on March 17, 1989 (see Appendix M. Sports Facilities). Responses to Comments on that supplement are presented in Volume Four, XV.Q. Sports Facilities.

As in Alternative A, community services, such as police and fire facilities and a recreation center, would occupy the Fire Station 30 area. The station would be restored and expanded to provide additional space, or additional facilities would be constructed. There would be a school site in the western portion of the Project Area between Owens and Sixth Streets, south of China Basin Channel. A cultural center would be on Third Street near Crescent Park. Other community facilities would be located within commercial and residential buildings.

The 20 houseboat berths and 35 pleasure-craft berths in China Basin Channel would remain. As in the EIR Alternatives, the I-280 stub and Fourth Street off-ramp would be removed and the interchange reconfigured to provide on- and off-ramps at King Street between Fifth and Sixth Streets; the CalTrain Station would be moved from its present location at Fourth and Townsend Streets to Seventh and Channel Streets.

MUNI Metro would be extended to the Project Area, with a stop opposite the CalTrain station and a final stop within the Project Area south of 16th Street. A MUNI Metro maintenance and repair yard and support offices would occupy the area bounded by Owens Street, I-280, 16th Street, and Mariposa Street. MUNI Metro tracks would parallel the CalTrain tracks south of the CalTrain station, but would descend below grade from the CalTrain station to pass under 16th Street to the maintenance and repair facility.

Two parallel bridges would cross the channel at Owens Street. The western bridge would be used by MUNI Metro; the eastern bridge would have one traffic lane in each direction plus a sidewalk.

The variant incorporates the most recent design for The Embarcadero and King Street leading into Mission Bay from the east. Within Mission Bay the mid-block segments of King Street would contain three travel lanes during the peak periods except in the westbound direction, which would have two lanes between Fourth and Third Streets. East of Third Street, however, King would narrow to two mid-block travel lanes in each direction.

The variant is most similar to Alternative A in terms of total employment. The mix of types of businesses and employment would differ from Alternative A, however. Most of the employment in the variant would be associated with office uses. The variant would provide about 17% more office employment and 70% less S/LI/RD-type employment than would Alternative A. Retail is a major employment category in the variant, providing three times more jobs than retail use in Alternative A. The variant would provide hotel-related employment identical to that in Alternative A, employment of a type that would not be provided in Alternative B or N.

With 8,000 housing units, there would be about 300 (4%) more units in the variant than in Alternative A. Population is estimated at about 16,400 residents, about 2,000 (14%) more than in Alternative A, due to larger units and an expected larger average household size. Compared to Alternative B, the variant would include 2,000 (20%) fewer housing units and about 2,300 (12%) fewer residents. Most of the housing units (about 72%) would fall in the medium density residential (MDR) range. About 18% would fall in the high density residential (HDR) range. About 10% of the units would be in a new housing density category, very high density residential (VHDR), representing densities over 150 dwelling units per acre. Fewer than 1% of the units would be medium-high density residential (MHDR) and none would be low density residential (LDR).

As with Alternatives A and B, both for-sale and rental housing would be developed. The housing would span a range of prices and rents. The variant would have 3,000 affordable housing units, representing a higher percentage of total housing built in Mission Bay than would be the case under Alternatives A and B (37.5% with the variant compared to 30% with Alternatives A and B). On average, the affordable units would be larger than would be the case under Alternatives A and B./24/ For the variant, affordable housing is defined as housing available at prices and rents affordable to low- and moderate-income households. The range of prices and rents for new affordable housing would include lower prices and rents than would be the case under Alternatives A and B./25/

PUBLIC PLANS AND POLICIES

As in Alternatives A and B, the variant would not respond to objectives of the City's Central Waterfront Plan, the Port's Conceptual Maritime Master Plan for the Southern Waterfront, and the regional Seaport Plan calling for the maintenance or expansion of maritime uses east of Third Street in Mission Bay. However, a recent amendment to the Seaport Plan would remove the inconsistency between the variant and the Seaport Plan, provided that certain conditions were fulfilled./26/ San Francisco's Central Waterfront Plan calls for a mixed-use residential neighborhood west of Third Street. West of Third Street, the variant generally would be consistent with the plan, as would Alternatives A and B.

LAND USE, BUSINESS ACTIVITY, AND EMPLOYMENT

Land Use Characteristics

The variant would represent a change in the land use character of the Mission Bay Project Area commensurate with the change represented by Alternatives A and B (see pp. VI.B.81-VI.B.83). The variant would be most similar to Alternative A, in terms of both the mix of uses and the geographic distribution of uses in the Project Area.

The magnitude of development in the variant could be absorbed by 2020. Full occupancy of the large amount of retail space would not occur until the surrounding residential blocks were well-established.

As described below in the analysis of retail activity, the amount of retail space in the variant is large relative to what could be supported by local spending. Consequently, personal and business services uses are likely to occupy second-floor space along Third Street.

Implications for Employment and Job Opportunities in Mission Bay

The amount of employment in the Project Area under the variant would be about 25,100 jobs, almost exactly the same as under Alternative A (see pp. VI.B.83-VI.B.88)./27/

In terms of occupations, wage/salary categories, and earnings and skill levels, the job profile for the variant would be very similar to that under Alternative A. The different mix of office, S/LI/RD/O, and retail uses would result in some differences, however. There would be a higher number and percentage of jobs in professional/technical, managerial/administrative, and clerical occupations and a higher share of jobs at the upper end of the wage/salary distribution because of the larger amount of office development in the variant. Also, since the variant would not have a large amount of S/LI/RD/O space, there would be fewer jobs in crafts, operatives, and other similar occupations than there would be under Alternative A, although there would be more of those types of job opportunities in the Project Area with the variant compared to the situation in 1985. The variant would result in somewhat more jobs in the lower wage/salary categories, reflecting the larger amount of retail space and the relatively high proportion of part-time and entry-level jobs in retail trade.

Over the course of the development period, the number of construction jobs generated would be similar to the number in Alternative A (12,700 person-years; see pp. VI.B.88-VI.B.90).

Employment Benefits to the Labor Force

As under Alternatives A, B, and N, jobs in the Project Area under the variant would employ San Francisco residents as well as residents of other parts of the region (see pp. VI.B.91-VI.B.93). As would Alternative A, the variant would offer a broader range and larger number of job opportunities compared to those in Alternatives B and N. Furthermore, with the larger amount of Mission Bay housing in the variant compared to Alternative A, a higher share of Project Area jobs might be held by City residents.

Implications for Existing Land Uses in Mission Bay

The overview description of Project Area business transition and location options for existing Mission Bay businesses presented on pp. VI.B.93–VI.B.96 would apply for the variant as it applies for Alternatives A, B, and N. The longer-term conclusions presented on p. VI.B.99 for Alternative A generally would apply for the variant. The option available to existing businesses of remaining in the lower-density S/LI/RD development with Alternative A would not be a possibility with the variant, however, since the limited amount of S/LI/RD/O space that might be developed would provide a smaller number and narrower range of choices than would be possible with Alternative A.

East of Third Street, the port-related land use in the variant could allow continued operation of the maritime and hazardous materials cleaning service business and tank farm located in that part of the Project Area. However, the amount of land area available for that business would be less under this variant, compared to the area it currently occupies. Consequently, as opposed to the situation in Alternatives A and B, those activities, as well as other industrial or maritime-related uses in that area, might not have to relocate as a consequence of Mission Bay development.

Maritime-Related Activity / Port-Related Land Use

The overview discussion and the specific conclusions for Alternative A related to options for maritime-related activity in Mission Bay apply for this variant (see pp. VI.B.101–VI.B.102 and pp. VI.B.115–VI.B.117). Approximately six acres of land east of Third Street would be reserved for port-related uses in the variant. This is about the same amount reserved under Alternative A (although in a different location). As discussed for Alternative A, the limited land area and the location near residential and hotel development make it unlikely that active maritime uses could function efficiently in the port-related area over the long term. The area could continue to be used for materials storage and for functions ancillary to those on adjacent piers.

The reserved port-related land in this variant would include about one-half of the acreage currently used by H&H Ship Services, an existing maritime and hazardous materials cleaning service business located opposite Pier 48. The remainder of the H&H site would become part of a proposed open space bounded by Third Street and China Basin. The hazardous materials handled by H&H are primarily waste petroleum products, such as waste oil pumped from decommissioned underground storage tanks. The loss of part of its space would be likely to cause H&H to relocate, requiring it to apply for a new Treatment, Storage or Disposal (TSD) permit at a new location (see note /49a/,

p. VI.B.133). The EIR has analyzed two time frames: the years 2000 and 2020. It is assumed that Mission Bay development would be phased to permit continued operation of the existing company through the first of the two time frames.

Were H&H to continue to operate at its current location after development of the open space area, the potential would exist for persons using the open space to be exposed to accidental toxic chemical releases or explosions from tank cleaning operations at H&H./28/ Such exposure is not likely if operations continue to comply with TSD permit conditions. Under relatively calm atmospheric conditions, petroleum fumes from H&H occasionally could annoy users of the open space; such limited exposure would not be considered a health hazard. Users would also be subjected to traffic from trucks hauling empty storage tanks or waste petroleum products to the H&H facility. Hazards from this traffic would be no different than hazards on any other city street subject to commercial traffic.

The conclusions for Alternative A related to future container terminal development adjacent to the Project Area also apply to the variant. A container terminal would require more acres in Mission Bay for backland than are designated for port-related use in the variant. A land exchange, such as that addressed in the recent Seaport Plan amendment, could provide a suitable substitute location in the vicinity of Piers 70 to 80 for potential future container terminal activity, so that San Francisco's long-term container handling capacity would not be adversely affected by development under this variant. If the conditions of the Seaport Plan amendment allowing development of a new marine terminal adjacent to the existing San Francisco container terminals rather than at Mission Bay were not met, then the variant would reduce future container handling capacity in San Francisco.

Retail Activity

The variant incorporates a large amount of retail space (750,000 gross square feet), substantially larger than the amounts in Alternatives A, B, and N. Retail space in Mission Bay would be supported by the spending of Project Area residents and workers as well as by spending of people from outside the Project Area. (For more background on the retail conclusions, see pp. VI.B.104–VI.B.106 and VI.B.117–VI.B.119.) With a supermarket in the Project Area, Mission Bay residents would do more of their convenience shopping in the Project Area than assumed for analysis of Alternatives A, B, and N, none of which are likely to provide for a supermarket site. Accounting for that difference and using a methodology similar to that used to analyze Alternatives A, B, and N, it is estimated that spending by Project Area residents and workers would support about 230,000 – 260,000 square feet of retail space in the Project Area under the variant.

Of the total retail space to be developed under the variant, about 160,000 square feet would be second-floor space most likely occupied by personal and business service activities primarily serving the Mission Bay neighborhood. If that space were subtracted from the total amount of space designated for retail uses, then there would be about 590,000 square feet of Mission Bay retail space to be supported by retail spending (750,000 - 160,000 = 590,000). About 330,000 to 360,000 square feet of that 590,000 square feet of retail space would depend on the spending of people from outside the Project Area.

Mission Bay retail space under the variant would have to include attractions drawing from a larger market area. The supermarket would offer convenient, lower-cost grocery shopping to residents of Potrero Hill and South of Market neighborhoods. With the variant, it is unlikely that a supermarket or neighborhood shopping center would be developed elsewhere in the vicinity outside Mission Bay. The other larger-scale retail development could be a discount outlet or other stores offering household goods and home improvement items, for example. Such stores draw customers from nearby neighborhoods and from throughout San Francisco. Moreover, for the large amount of Mission Bay retail space to be absorbed, it is likely that the neighborhood commercial street would develop with a high proportion of eating and drinking places and specialty shopping, attracting people to Mission Bay. Developing such a special character takes a long time. Until that happened, there would be somewhat less occupied retail space in Mission Bay than envisioned in the variant.

Another issue related to retail activity in Mission Bay is the effect on neighborhood commercial streets elsewhere in San Francisco. Under the variant, a successful neighborhood commercial street in Mission Bay would compete with neighborhood shopping streets nearby (e.g., on Potrero Hill or in the Mission District). There would be less sales growth in those areas than otherwise under Alternatives A, B, and N. As mentioned above, such competition would only develop over the long term. Moreover, the special character and flavor of the older, established districts would continue to attract shoppers, including Mission Bay residents. The large amount of new retail development incorporated in the variant would be likely to have more effect on the potential for other new retail in South Beach, Yerba Buena Gardens, Showplace Square, and other South of Market locations. The sites for larger stores in the Project Area would result in less of that type of development occurring somewhere else in the southeast part of the City.

On the other hand, Mission Bay development under the variant would contribute to sales growth in other retail districts in the City, primarily as a consequence of the spending attributable to the relatively large number of new Mission Bay residents. As in Alternatives A and B, the people living in Mission Bay would shop for such items as apparel, home furnishings, appliances, and automobiles in shopping areas in San Francisco outside Mission Bay. They also would patronize restaurants and shops along the City's many popular neighborhood streets.

Implications for Nearby Industrial and Commercial Areas

The overview discussion of the timing and types of effects of Mission Bay development on land use, business activity, and employment in Nearby Areas applies for the variant as well as for the Alternatives (see pp. VI.B.106-VI.B.109). The description of the effects of Alternatives A, B, and N (see pp. VI.B.109-VI.B.117) also is useful background for the following comparative analysis.

Generally, the variant would be very similar to Alternative A in terms of impacts on the pace of development and land use change in the South of Market, other parts of the Downtown & Vicinity, and nearby industrially zoned areas. Compared to Alternatives B and N, there would be less pressure for office development in Nearby Areas with the large amount of Mission Bay office space proposed for the variant. Because the variant does not incorporate a large amount of lower-rise, lower-cost commercial/industrial development (i.e., S/LI/RD or M-2 Industrial space), it would result in land use patterns similar to those of Alternative B in areas to the west and south of the Project Area. Showroom and related activity and some production, distribution, and warehousing businesses would look for substitute locations in the North Potrero, Inner Mission, Lower Potrero, and Central Bayfront districts since Mission Bay would not provide options for those types of business activities.

Implications for Citywide and Regional Growth and Development Patterns

The rationale for determining how the various options for Mission Bay development would affect development patterns and the amount of employment growth in San Francisco and other parts of the region is described on pp. VI.B.119-VI.B.121. For this aspect of the analysis, the consequences of the variant would be similar to those of Alternative A (see p. VI.B.121).

The variant, like Alternative A, would enable San Francisco to compete with the suburbs for lower-cost back-office development that otherwise would have difficulty finding suitable locations in the City. Consequently, there could be somewhat more office development overall in the City and less elsewhere in the region compared to the situation with Alternatives B and N. The larger amount of office space in the Project Area under the variant compared to Alternative A would result in somewhat less pressure for new office development in other parts of the Downtown & Vicinity.

Because the variant does not incorporate the large amount of S/LI/RD development included in Alternative A, there would be more of that type of development and employment growth outside San Francisco and in industrially zoned areas in San Francisco to the west and south of Mission Bay.

HOUSING AND POPULATION

Implications for Households and Population in the Project Area

By build-out, Mission Bay under the variant would have 8,000 new housing units and about 16,400 residents./29/ The variant would result in substantially more housing and population than Alternative N, somewhat more than Alternative A, and less than Alternative B.

As in Alternatives A and B, new residential development in Mission Bay under the variant would provide a mix of types and sizes of new units and would accommodate a mix of different households and people. Although the general description for Alternatives A and B on pp. VI.C.64-VI.C.65 would apply for the variant, there also would be some differences. In the variant, there would be units with lower price/rent levels than in Alternatives A and B. In addition, a higher percentage of the units would be affordable and the overall average unit size would be somewhat larger compared to Alternatives A and B. (See discussion of Variant 8 on pp. VII.47-VII.51 for additional background.)

The differences in housing unit size result in differences in the characteristics of households in Mission Bay. Households would be larger and there would be more workers per household, on average. There also would be proportionally more children. Although the number of housing units, households and employed residents in Mission Bay under the variant would be most similar to Alternative A, the total population in the Project Area would fall somewhere between the amount estimated for Alternative A and that estimated for the larger residential community in Alternative B./29/ This is because the larger unit sizes in the affordable housing category would provide opportunities for more families with children to live in Mission Bay than would be the case with Alternative A.

Since the range of prices and rents for affordable units would include lower-priced units than assumed for the Alternatives, the variant would provide opportunities for households with lower incomes to live in the Project Area that would not be available with the affordable price/rent structure assumed for Alternatives A and B. Consequently, average household income in Mission Bay would be lower under the variant.

Implications for Nearby Residential Areas

The implications of Mission Bay development under the variant for nearby residential neighborhoods would be similar to those of Alternatives A and B (see pp. VI.C.86-VI.C.92). As with those Alternatives, a strong direction for the types of changes attributable to Mission Bay development is difficult to predict, since the various features of the variant would have offsetting implications.

Since the variant would represent an upgrading of the urban environment in that sector of the City, it could potentially contribute to increased demand for housing in those older residential neighborhoods in the vicinity. On the other hand, the variant would add a substantial amount of housing to the City's stock, absorbing some of the demand for housing that otherwise would contribute to gentrification in nearby neighborhoods.

For residents of nearby neighborhoods, the variant would provide more in the way of public facilities and retail shopping opportunities than would Alternatives A, B, and N.

Project Area Jobs/Housing Relationship and Implications for the City's Housing Market

Relationship Between Project Area Employment Growth and Housing Development

For office development under the variant, the City's OAHPP would require either payment of an in-lieu fee of $39.56 million for production of housing or construction of 2,200 housing units, 1,364 to be affordable to households of moderate or lower income./30/ The number of housing units to be built in the Project Area under the variant (8,000) would more than satisfy the OAHPP housing construction requirement. The price assumptions for the 3,000 affordable units in the Project Area under the variant imply affordability to households of moderate and low incomes, and indicate that the 1990 OAHPP affordability requirement is likely to be met./30a/

As with Alternatives A and B, the number of housing units to be built in the Project Area would exceed the number of units needed in San Francisco to accommodate Project Area employment growth. The estimated number of units to accommodate additional

San Francisco households with Project Area workers (about 3,620) would represent about 45% of the number of new housing units to be built in the Project Area (8,000)./31/ The remainder would represent housing available to accommodate other demand besides that associated with Mission Bay employment growth, thus improving the City's ability to accommodate other households looking for housing in San Francisco.

Affordable housing is defined differently for the variant than for Alternatives A and B. The range of prices and rents for new affordable housing under the variant would include lower prices and rents than would be the case under Alternatives A and B. For the variant, affordable housing includes housing available at prices and rents affordable to low- and moderate-income households. For comparison, the range of prices and rents for affordable housing in Alternatives A and B would include prices and rents affordable to middle-income households and households in the higher ranges of the moderate-income category. In those Alternatives, there would be no housing affordable to low-income households or to households in the lower ranges of the moderate-income category.

For analysis, the affordable housing under the variant is assumed to be priced to be affordable to households with incomes ranging from 50% to 120% of median household income. Additional San Francisco households with Project Area workers could require about 1,620 units of housing in this price range./32/ That number of units would account for about 54% of the affordable units to be built under the variant. The remaining affordable units (about 1,380 units) would represent housing for other low- and moderate-income households in San Francisco.

The majority of additional San Francisco households with Project Area workers would be able to afford housing in the Project Area under the variant. The percentage of worker households who could afford Project Area housing would be higher under the variant than under Alternatives A and B because of the broader range of prices and rents for affordable housing under the variant.

Despite the broader range of affordability for housing under the variant, there still would be some additional demand in San Francisco for lower- and higher-priced affordable housing as a result of Project Area employment growth./32/ There would be additional San Francisco households of Project Area workers with household incomes below those needed to pay for affordable housing in Mission Bay (incomes below 50% of median household income). This additional demand would increase competition for units at the low end of the price/rent range for housing in San Francisco. There also would be additional households of Project Area workers with household incomes above those for which the Mission Bay affordable housing is targeted but below those needed to pay for market-rate housing in Mission Bay (assuming market-rate housing prices similar to those for Alternatives A and B). This additional demand might be met by other market-rate housing production in San Francisco. Also, to the extent lower-priced market-rate units in Mission Bay relieved demand pressure for existing housing elsewhere in the City, that would indirectly reduce the competition faced by those households with incomes between those targeted by the affordable housing and those needed to pay for the market-rate housing. However, the households in this group also could add to the demand for existing housing in San Francisco.

Comparison with the Alternatives and Implications for Citywide Housing Market Conditions

The variant would be most similar to Alternative A from a jobs/housing perspective, resulting in about the same amount of Project Area employment growth and somewhat more housing development in Mission Bay. (The jobs/housing analysis for Alternatives A, B, and N is on pp. VI.C.70–VI.C.77. General discussion of the implications for citywide housing market conditions is on pp. VI.C.81–VI.C.86.) Compared to Alternative A, there would be fewer market-rate units (390 fewer units) and more affordable units (690 more units). Compared to Alternatives A and B, the variant would produce affordable housing priced at lower levels, thus providing housing to a broader range of households with incomes below those needed to purchase or rent new market-rate housing. The larger average size of affordable units under the variant would be of particular benefit in San Francisco, where there are not many options for producing affordable housing large enough for families.

The large amount of housing in Mission Bay would expand the City's housing stock across a range of prices and rents. The new housing would accommodate households that otherwise would compete for existing housing. Of particular benefit would be the addition of affordable housing available over a range of prices and rents since such units are difficult to produce in San Francisco and will remain in strong demand in the future.

Compared to Alternatives A and B, the variant would be of more benefit to moderate- and low-income households in the market for affordable housing in San Francisco and to family households seeking affordable housing. The variant would be less beneficial than Alternatives A and B to middle-income households seeking affordable units priced just below the level required for producing new market-rate housing. It also would provide fewer opportunities for single-person and other smaller households seeking affordable housing than Alternatives A and B.

Alternative B is likely to be preferable to the variant from an overall housing market perspective, because it would add more to housing supply in the City and relatively less to housing demand associated with Project Area employment growth. However, in terms of affordable housing, the variant would add new units at lower prices and rents than those to be built under Alternative B. Consequently, unlike any of the Alternatives, the variant would provide housing opportunities in the City for some of those who otherwise would have to make more adjustments and sacrifices under the housing market conditions expected to prevail in San Francisco over the long term.

Implications for the Housing Market in the Rest of the Region

Mission Bay under the variant, and the citywide cumulative context of which it would be a part, would contribute to regional housing market conditions in the future. The effects of the variant would be similar to those of Alternative A (see pp. VI.C.92–VI.C.97). Generally, the development program for Mission Bay would influence the source and location of housing demand in the region but would have little effect on the total magnitude of regional housing demand and on overall regional housing market conditions.

Like Alternatives A and B, the variant would rezone what is now industrial land for a substantial amount of housing development in San Francisco. Compared to Alternative N, the rezoning would improve the City's balance of jobs and housing and would accommodate housing that otherwise would be built elsewhere in the region.

COMMUNITY SERVICES AND INFRASTRUCTURE

Fire Protection

In 2020, about 5% more fire/non-fire incidents would be expected under this variant than under Alternative B, which has the highest number of incidents among the EIR Alternatives./33/ As in Alternatives A and B, an engine company and a truck company, with accompanying personnel, would have to be added to maintain adequate levels of service in Mission Bay and the surrounding areas. As in Alternative A, renovation and expansion of closed Fire Station 30 could accommodate required firefighting equipment and personnel. As in the Alternatives, the existing high-pressure water system would need to be upgraded to serve the interior portion of the Project Area adequately.

Police Protection

In 2020, the number of police incidents would be about 4% lower than the number of incidents in Alternative A and about 8% lower than the number of incidents in Alternative B due to the different mix of land uses (i.e., less S/LI/RD-type development than in Alternative A and a smaller residential population than that in Alternative B)./34/ Personnel, equipment, and space requirements would be about the same as in Alternatives A and B. As in Alternatives A and B, necessary additional police personnel could not be accommodated in existing police stations.

Public Schools

The variant would have a greater impact on SFUSD enrollment than would any of the Alternatives. Approximately 2,140 SFUSD students are projected to live in the Project Area under the variant in the year 2020, about 48% more than the number of students under Alternative A and about 14% more than the number of students under Alternative B. As in Alternatives A and B, existing schools in the adjacent Nearby Areas and the district as a whole would not have sufficient space to accommodate these students. Project Area students would require about 40 elementary classrooms, 19 middle-school classrooms, and 20 high-school classrooms (representing more than two elementary schools, 61% of a middle school, and 31% of a high school). About 130 teachers/staff members would be needed.

The development agreement application identifies a 1.6-acre area northeast of Owens Street as a school site. If an elementary school were developed at that site, it typically would accommodate about 450 students, about 22% of the total number of students projected to live in the Project Area. If developed as a middle school, about 850 students could be accommodated.

Parks and Open Space

The open space network for the variant is shown in Figure VII.9, p. VII.85. Open space provided encompasses the following two major corridors of open space and several smaller areas:

- Bayfront Open Space: About 24 acres of open space bordering most of the eastern edge of the Project Area. This open space would provide a link between Mariposa Street and China Basin Channel and would provide views of the Bay. Areas for active recreation would be included west of the port-related backlands (south of the extension of Pier 48) and on the block northeast of Esprit.

- Mission Creek Park: About 16 acres along the north and south sides of China Basin Channel. Areas along the channel would provide passive open space; open space north of the school site would provide space for active recreation.

- Neighborhood Parks and Paths: About 11 acres of smaller neighborhood parks and paths scattered throughout the Project Area. Those open space areas would be devoted primarily to passive recreation.

The variant would provide 62.8 acres of open space, including the 12-acre China Basin Channel, about 14% more open space than provided in Alternative A (55.3 acres) and 33% less than in Alternative B (94.1 acres). The variant could pose some land use compatibility problems (e.g., noise) between port-related uses and the adjacent open space.

The variant would respond to applicable open space policies with the exception of Policy 1 of the Recreation and Open Space Element, which calls for the City to increase the per capita supply of open space to the extent it reasonably can above the current ratio of about 5.5 acres per 1,000 population. With about 50.8 acres of open space provided, excluding the 12-acre China Basin Channel, the variant would provide about 3.1 acres per 1,000 population (as compared to 3.0 acres per 1,000 population in Alternative A and 4.4 acres per 1,000 population in Alternative B). As with Alternatives A and B, the variant would not meet NRPA standards of five acres per 1,000 residents for neighborhood-serving and district-serving open space./35/ Personnel requirements would fall between those of Alternatives A and B (approximately 35 to 40 persons).

Other Facilities and Services

At build-out, water demand and wastewater generation would be about 4% lower under the variant than under Alternative A. Solid waste generated under the variant would be higher than in Alternatives A and B (about 8% and 3% higher, respectively). Impacts on other community services would be similar to impacts in Alternatives A and B.

TRANSPORTATION

The variant would have about 2,000 more residents (and 440 more employed residents) than would Alternative A, resulting in about a 5% increase in p.m. peak travel demand entering the Project Area over Alternative A. There would be about 120 more workers under this variant than in Alternative A, resulting in about the same p.m. peak travel demand leaving Mission Bay.

The total p.m. peak-period travel demand generated by this variant would be about 2% higher than that forecast for the Project Area for Alternative A, but would not significantly change projections of cumulative screenline travel demand./36/ The inclusion of more housing units within the Project Area than projected under Alternative A, however, would increase opportunities for downtown employees to live in the Downtown & Vicinity, thus decreasing commute trips that would cross MUNI or regional screenlines.

Off-peak travel demand within the Project Area associated with retail uses on Third and Long Bridge Streets would increase under this variant, similar to Variant 4 (see pp. VII.28-VII.29), although many of these trips would be expected to be by pedestrian and transit travel.

Parking supply rates and demand ratios used for the variant are the same as those used for Alternative A. The proposed development in this variant would provide approximately 14,800 off-street spaces. An estimated parking demand of about 17,260 spaces for this variant would result in a parking deficit for the Project Area of about 1,540 spaces./37/ Mitigation measures to reduce parking impacts for Alternative A (described in VI.E. Transportation, pp. VI.E.207-VI.E.209 and pp. VI.E.222-VI.E.223) would apply to this variant as well.

Freight loading and service vehicles connected with retail uses on Third and Fourth Streets would generate more truck traffic and demand for off-street loading spaces on these major north - south thoroughfares, potentially resulting in more traffic disruption than would Alternative A. The Transportation Element of the Master Plan identifies both of these streets as Transit Preferential Streets. The Planning Code (Section 155) discourages access to loading from streets so designated to reduce conflicts with transit vehicles. Truck loading access south of the channel, however, could be provided from alleys parallel to Third Street to minimize this impact.

The roadway network under the variant would generally share the freeway and street characteristics of the three Alternatives. As with the Alternatives, alignment of all streets in the Project Area north of China Basin Channel would follow the existing South of Market grid. South of the channel, the street grid would follow a mixed grid (South of Market grid generally west of, and the Third Street grid east of, Long Bridge Street). Differences include expanded access between the Project Area and existing neighborhoods to the west, via a connector street between Owens and Seventh Streets near Hooper Street, and via Berry Street, which would access Seventh Street. The

Hooper Street connector would not significantly affect trip distribution of vehicles between the Project Area and areas to the west because it is designated exclusively for transit access to serve the transfer point between CalTrain and MUNI systems.

In 1989, the San Francisco Departments of City Planning and Public Works, MUNI, and the San Francisco Redevelopment Agency reached agreement on a cross-section design that would provide two travel lanes in each direction along The Embarcadero and on King Street west to Third Street, and in the westbound direction of King Street west to Fourth Street. The remainder on King Street up to the I-280 ramps would provide three lanes during peak periods. This design revision, which is incorporated in analysis of this variant, has been forged partly to incorporate the on-going planning for Mission Bay, but primarily to proceed with implementation of the components of the I-280 Transfer Concept Program.

As a result of the roadway design differences described above, levels of service for intersections north of the channel would be noticeably different with the variant from those projected for Alternative A. As shown in Table VII.2, the primary differences would be that the levels of service for the variant would be improved for intersections on King Street and degraded for intersections on Berry and Townsend Streets. The primary changes would be for intersections along Third Street, with intersections on Townsend, King and Berry in equilibrium between capacity and demand. Less drastic changes are projected for the intersections along Fourth Street. All intersections, however, would operate at an acceptable level of service (D or better).

The conflict between at grade CalTrain operations to/from its Seventh and Channel Streets terminal in Alternatives A and B and this variant would decrease the p.m. peak-hour service level at the intersection of 16th and Seventh/Mississippi Streets from LOS B to LOS D by the year 2000. This assumes that the same number of trains are in service during the p.m. peak period as in 1985. If the number of trains were increased during the peak period level of service would degrade to E. See Volume Four, XV.E. Transportation, pp. XV.E.25-XV.E.26, for further discussion.

As noted under the description of this variant, a MUNI Metro maintenance and repair yard would occupy the area bounded by Owens Street, I-280 (the SP mainline), 16th Street, and Mariposa Street. If that facility were constructed before the year 2000, the "wye" portion of the 16th Street lead track (see Figure VI.E.6 on p. VI.E.23) providing freight-car access to the Illinois Street tracks would be removed. The Illinois Street tracks connect with the Belt Line tracks serving the waterfront north of China Basin Channel, and provide freight rail access south to the Port's North Container Terminal just

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TABLE VII.2: DIFFERENCES IN P.M. PEAK-HOUR LEVELS OF SERVICE PROJECTED FOR SELECTED INTERSECTIONS, ALTERNATIVE A AND VARIANT 12, 2000 AND BUILD-OUT/2020 •

	Alternative A /a/		Variant 12 /b/	
	V/C	LOS	V/C	LOS
		2000		
Intersection				
Fifth and King Streets	0.77	C	0.78	C
Fourth and King Streets	0.85	D	0.64	B
Third and King Streets	0.89	D	0.77	C
Third and Berry Streets	0.62	B	0.62	B
Third and Townsend Streets	0.57	A	0.63	B
Fourth and Townsend Streets	0.50	A	0.64	B
		2020		
Fifth and King Streets	0.88	D	0.88	D
Fourth and King Streets	0.97	E	0.71	C
Third and King Streets	1.02	F	0.85	D
Third and Berry Streets	0.73	C	0.85	D
Third and Townsend Streets	0.68	B	0.87	D
Fourth and Townsend Streets	0.57	A	0.80	C

/a/ VI.E. Transportation, pp. VI.E.167–VI.E.168.
/b/ Reflects effects of diversion of traffic to Berry and Townsend Streets caused by the 1989 revisions to the roadway design for The Embarcadero and King Street.

SOURCE: Barton-Aschman Associates

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north of Islais Creek. The Port requires that access to the Illinois Street tracks from 16th Street be retained; this loss of the "wye" would require an interim replacement for the (east) 16th Street lead.

Options for a permanent replacement for the 16th Street lead track are presented in the EIR on pp. VI.E.153–VI.E.154, VI.E.156, VI.E.178, VI.E.182–VI.E.183, and VI.E.221–VI.E.222. Those options are proposed as permanent mitigation for Alternatives A and B, and could be applied to this variant as well. However, it is possible to provide a temporary rail access in the interim, before the variant is fully built. To maintain freight-car service to the Illinois Street areas, new interim trackage could be constructed on the north side of 16th Street (or in the street itself), from the SP mainline to just west of Third Street, where it would join the existing lead track going northeast across Third Street to Illinois Street.

Freight trains would proceed north on the SP mainline into the proposed CalTrain terminal at 7th and Channel Streets, then back up onto the interim trackage on 16th Street. Detailed engineering would be necessary to coordinate construction and operation of the interim trackage with adjoining land uses. The maximum length of trains that could use this interim trackage would be about 1,000 feet (maximum of eleven 89-foot cars) because of the relocation of the CalTrain terminal from Fourth and Townsend Streets. Because trains currently running to the Port's North Container Terminal have comparable train-length limitations at the SF-SP Illinois Street Interchange Yard, and because the Port's North Container Terminal rail operations are not now hampered by that limit, this new limitation would create no change in Port rail operations.

AIR QUALITY

As with Alternatives A, B, and N, motor vehicle exhaust emissions would be the primary source of pollutants with this variant. Vehicle miles traveled, and therefore air emissions, in the variant would be about the same as those in Alternative A./38/

As in the Alternatives, emissions of carbon monoxide, hydrocarbons, and nitrogen oxides from vehicle trips generated by the variant at build-out would exceed 1% of county-wide transportation emissions of those pollutants, and thus would be considered potentially significant by the Bay Area Air Quality Management District. Roadside carbon monoxide concentrations in the vicinity are expected to be within state and federal standards. As in the Alternatives, although the variant would be consistent with 1982 Bay Area Air Quality Plan strategies encouraging development in established areas, the land use and population projections for the variant exceed those on which the plan was based.

NOISE

The effects of the local noise environment on the variant, and the variant's effects on the local noise environment, would be similar to those of Alternative A. Noise from port-related uses on backlands adjacent to the Pier Park could detract from enjoyment of that open space, although noise would generally interfere less with the active open space proposed there than it would with passive open space. The extension of MUNI Metro to the southern end of the Project Area would introduce a new noise source to the corridor now occupied by I-280 and CalTrain. As with the Alternatives, future noise levels in the Project Area with the variant would noticeably increase over existing noise levels due to increases in traffic.

ENERGY

Energy consumed in construction of the project and in project-related transportation would be about the same as that in Alternative A; total operational energy consumption by buildings would be about 10% lower, largely because there would be less S/LI/RD-type space than in Alternative A.

ARCHITECTURAL RESOURCES AND URBAN DESIGN

As in Alternative A, the variant would retain architecturally interesting Fire Station 30 (at the intersection of Third, Fourth, and Mission Rock Streets) for community facilities. The character and scale of development under the variant would be generally similar to that under Alternative A. As with Alternatives A and B, the variant would represent a change from predominantly low-rise, industrial buildings to mixed-use neighborhoods.

The scale of development would generally increase toward the north. As in Alternative A, office buildings up to 110 feet in height would dominate the area north of China Basin Channel. Similar to those in Alternative B, residential buildings from three to four stories in height would dominate the central portion of Mission Bay. Residential and S/LI/RD/O buildings along the southwestern boundary of the Project Area, near I-280, would be up to 85 feet in height; this would be generally higher than in Alternative A and lower than in Alternative B.

Relatively large, linear open space areas would follow the channel and the eastern border of the Project Area. Those open space corridors would provide more continuous open space than Alternatives A or B, and would establish visual boundaries separating uses north and south of the channel and defining the eastern border of the Project Area. The open space along the eastern edge of the Project Area would provide views of the Bay. Other smaller open-space areas and paths would be distributed throughout the Project Area. Landscaped jogging trails would provide connections to the west and south sides of the site.

Effects of the variant on long-range and street-level views would be similar to effects under Alternative A.

CULTURAL RESOURCES

As in Alternatives A, B, and N, development under the variant would take place in areas that could contain subsurface artifacts (see Figure VI.J.1, p. VI.J.17). Potential impacts would be generally similar to those under Alternatives A and B, although excavation required to depress the MUNI Metro tracks and construct the maintenance facility could increase the potential to encounter cultural resources (the MUNI facility would be located near Point San Quentin / Point Potrero, in an early shipbuilding area).

GEOLOGY AND SEISMICITY

Similar to Alternatives A and B, the variant involves development of housing and commercial uses in a seismically active region, and in an area of San Francisco susceptible to earthquake hazards. Casualties in the Project Area from a daytime earthquake (2:00 p.m.) could be slightly higher than in Alternative A, as the daytime population (employees, residents at home during the day, and 40% of hotel guests) would be about 4% higher due to the additional housing and higher proportion of children in the variant. Casualties from a nighttime earthquake (2:00 a.m.) would fall between those in Alternatives A and B, as the nighttime population would fall between the nighttime populations in those Alternatives.

VEGETATION AND WILDLIFE

Mission Creek Park

About 16 acres of open space would surround China Basin Channel. There would be about a five-acre strip of park-like public open space north of the channel, adjacent to residential buildings. As with Alternative B, the channel would not be dredged. The north edge would be gabions, riprap, or similar edge treatments along the channel. The linear open space parallel to the channel would have a high level of human activity. Gulls would rest on the lawn areas. As in Alternative A, other wildlife species that might benefit from the park as an increase in habitat would be animals that are not sensitive to human activity.

There would be about 11 acres of open space along the south bank of China Basin Channel. As with Alternative A, increased human activity in the vicinity could substantially reduce or eliminate heron and egret use of the shoreline. Some birds may continue to rest on the banks and on piers and pilings and to fish and hunt along the south bank. The bank could be improved for animal use by reducing the elevation of the fill in the park area to broaden the zone in which marsh plants would grow. Pickleweed would spread readily and plants such as jaumea, salt grass, gum weed, and salt marsh lavender could be planted. Ducks and other water birds might use the widened bank as a resting area.

As with Alternative A, the open water in China Basin Channel would continue to provide feeding and resting habitat for common gulls and water birds.

Bayfront Open Space

Open space would border most of the eastern edge of the Project Area in the variant. The park east of Third Street, between the extension of Pier 48 and Mission Rock Street, and the park northeast of Esprit would be used for active recreation. The other open space along the eastern edge of the Project Area would have a high level of use. The Bayfront open space would provide habitat only for those species of wildlife that are not sensitive to human presence. Because of its proximity to the Bay, gulls would rest on the lawn areas.

Small Parks

Neighborhood areas of park-like open space and jogging paths are proposed in other portions of the Project Area. That open space would receive a high level of human activity and provide habitat only for those species of wildlife that are not sensitive to human presence.

HAZARDOUS WASTE

Surface soil, subsurface soil, and groundwater at Mission Bay could potentially be contaminated with hazardous wastes. Overall impacts would be similar to those in Alternatives A and B. However, excavation required to depress the MUNI Metro tracks and construct the maintenance facility could increase the potential to encounter potential hazardous waste deposits. The MUNI Metro right-of-way and maintenance facility would be located in portions of Mission Bay that have been used by paint and chemical industries, oil storage and processing facilities, rail-related maintenance and repair facilities, and rail trackage.

If the Mission Bay Hazards Mitigation Program were to apply to the variant as it would to Alternatives A and B, portions of the Project Area proposed for development in the variant and appropriate buffer zones would be investigated, and any necessary clean-up would be completed before work in each development phase area began.

GROWTH INDUCEMENT

Generally, the growth inducement effects of the variant would be similar to those of Alternative A (see pp. VI.O.1–VI.O.9 for a description of relevant growth inducement issues and comparison of Alternatives A, B, and N). Most of the growth inducement issues (net addition to citywide employment and population, regional development patterns, and spillover effects in Nearby Areas) are discussed in the Land Use, Business Activity, and Employment section and the Housing and Population section of this analysis of the variant. Regional growth inducement issues and multiplier effects are summarized below.

From the regional perspective, there would not be much difference among the variant and the Alternatives in total employment and population growth, but there would be some differences in the locations for growth and development in the Bay Area. In this respect the variant would be most similar to Alternative A. With employment growth concentrated in San Francisco, there would be less job growth and fewer impacts stimulated by job growth and associated population growth in other parts of the region than would be the case with Alternative B, for example.

As with the Alternatives, economic activity in Mission Bay under the variant would support and would be supported by economic activity elsewhere in the City and the region. Those economic inter-relationships are identified as multiplier effects. The magnitude of multiplier effects associated with the variant would be similar to the situation with Alternative A. Both would generate a larger amount than either Alternative B or Alternative N.

MITIGATION

Mitigation measures for Alternative A (see Mitigation sections in Chapter VI. Environmental Setting, Impact and Mitigation) would apply to this variant. However, the variant's roadway design incorporates intersection widenings on King Street at Third and Fourth that would eliminate the need for including Mitigation Measure E.29a identified in Alternative A. Mitigation Measure E.4a, for a Transit Impact Development Fee, would apply to S/LI/RD/O in this variant. (See VI.E. Transportation, p. VI.E.201, for this measure.)

A measure covering possible continued operations of H&H Ship Services adjoining proposed open space use would apply to the variant, as follows:

- Should H&H Ship Services continue to operate after development of the proposed open space area fronting China Basin: one way to mitigate would be to construct a wall approximately 16 feet in height engineered to withstand potential explosion hazards from tank cleaning operations (or develop some other effective engineering solution); and design the open space to set high-public-use areas back from the H&H property line.

NOTES - Variations on Alternatives

/1/ To the extent that building the remaining blocks to greater density would increase M-2 space construction costs and decrease parking and delivery vehicle access, some businesses may find locations outside the Project Area to be relatively more attractive than M-2 space in the Project Area. In that case, it is possible that the remaining M-2 blocks west of Third Street would absorb somewhat less than the full amount of M-2 space replaced by housing; impacts would be proportionally less.

/2/ Chapter VI.E. Transportation contains an extensive discussion of travel demand forecasting for the Project Area, Downtown and Vicinity, and the rest of the region, and the effects of this projected travel demand on operating conditions at screenlines (highways and transit), local intersections and on MUNI routes serving the Project Area. For highways at the regional screenlines, at build-out (pp. VI.E.106-VI.E.109), small numerical differences in outbound traffic during the p.m. peak period and hour among Alternatives A, B and N do not produce significantly different impacts in terms of the duration of congestion. For transit systems (pp. VI.E.115-VI.E.122), cumulative transit ridership at screenlines is forecast not to be different among Alternatives A, B and N, except for the South Bay screenline. A significantly higher CalTrain ridership under Alternative N than under Alternative A or B could be caused by the relocation of the San Francisco CalTrain terminus further from the downtown employment center with the latter Alternatives. As shown in Table VI.E.20 (p. VI.E.130), however, there would be no significant differences in cumulative outbound transit levels of service during the p.m. peak period and hour among the Alternatives. For local intersections (pp. VI.E.166-VI.E.175), very few differences exist among Alternatives A, B and N for 2020 Levels of Service (Table VI.E.26, pp. VI.E.167-VI.E.168), and these few differences are too small to be considered significant. For MUNI routes serving the Project Area, 2020 Levels of Service (Table VI.E.27, p. VI.E.177) with Alternative B would be worse than with Alternatives A or N, as the larger number of residents in Alternative B would generate more southbound (peak direction) p.m. peak-period trips than would the other Alternatives.

/3/ Office employment in lower-rise S/LI/RD space is estimated assuming 300 square feet per employee. This is a somewhat lower density (more space per worker) than that assumed for the major office development in Mission Bay (275 square feet per employee). The office density for this variant reflects higher employment density (less space per worker) than the average densities (405 square feet per employee and 465 square feet per employee, respectively) assumed for S/LI/RD activities in Alternatives A and B. Employment densities are presented in Appendix A. The EIR Alternatives, Table XIV.A.2, p. XIV.A.10. The density factors apply per gross square foot of occupied space after accounting for a 5% vacancy.

/4/ For the purposes of the EIR analysis, affordable housing units were defined according to the terms of the Mayor's Letter to Southern Pacific: prices would range from $105,000 to $150,000, with an average price of $125,000 in 1984 dollars. There also would be units available at comparable affordable rents.

/5/ In addition to the discussion of the CalTrain station in this chapter and in VI.E. Transportation, see "CalTrain Station Locations," Special Study for Mission Bay, prepared by Barton-Aschman Associates for the San Francisco Department of City Planning, September 1986, and the DKS Study "Patronage Effects of the CalTrain Station Relocation," November 1986.

• /5a/ San Francisco Department of City Planning, CalTrain Station Locations, Special Study for Mission Bay, prepared by Barton-Aschman Associates, Inc., September 1986.

• /5b/ Perkins, Jeanne B., The San Francisco Bay Area -- On Shaky Ground, Association of Bay Area Governments, February 1987.

• /5c/ Lawson, Andrew C., et al., The California Earthquake of April 18, 1906: Report of the State Earthquake Investigation Commission, 2v and Atlas, Carnegie Institution, Washington, D.C., 1908.

• /5d/ Blume, John A., San Francisco Seismic Safety Investigation, Geologic Evaluation, URS Associates, June 1974.

/6/ Franklin Lew, Manager of Special Projects Unit, San Francisco Department of Public Works, telephone conversation, July 15, 1988.

• /7/ However, amendments to the MTC/BCDC Seaport Plan, approved March 16, 1989, would permit deletion of the designation of Piers 52-64 as Near-Term marine terminals suitable for container development use if:

1) All of the former Western Pacific property at Warm Water Cove is transferred from Santa Fe Pacific Realty Corporation to the Port (see p. V.42 regarding this land exchange), and

2) The Port and City develop a strategy to ensure Port-Priority Use Areas are reserved for port purposes, and non-port-owned areas needed for marine terminal uses at Piers 70 to 80 are available.

• /8/ The amount and configuration of land is close to but not exactly that shown for the Pier 50-Alternative 4 concept described in San Francisco Department of City Planning, "Container Terminal Options," Mission Bay, San Francisco, Special Study for Mission Bay, prepared by Moffat and Nichol Engineers, September 1986, pp.16, 33-35.

• /9/ Regina Sneed, Mission Bay Clearinghouse, letter to Sue Bierman, President, and Members of the Planning Commission with three-page summary of the Mission Bay Citizens' Alternative, November 17,1988.

• /10/ Office uses that might occupy space in the Service/Commercial land use category are assumed to be smaller businesses in buildings offering less than 25,000 square feet of space for office tenants. (The OAHPP requirements do not apply to office development under 25,000 square feet.)

- /11/ The estimate of additional housing units to accommodate San Francisco households with Project Area workers and the estimate of additional housing units in the affordable category were developed using the approach followed in analyzing the jobs/housing relationship for Alternatives A, B, and N. The approach is described on pp. VI.C.68-VI.C.70, and background is provided in Volume Three, Appendix C, pp. XIV.C.29-XIV.C.37. Values in the calculations that reflect the cumulative context were estimated for the variant based on the work done for Alternatives A, B, and N. Background on the calculations is provided in working papers available for review at the Department of City Planning, 450 McAllister, San Francisco.

  The live/work land use in the variant was evaluated separately from the other land uses, and the results were combined to produce the estimates presented herein. The evaluation of the live/work use followed a comparable approach to that used for evaluating the other land uses, adjusting for differences in the jobs/housing characteristics of live/work activities and using additional data from the 1984 South of Market Artist Live/Work Space Survey conducted by the Department of City Planning.

- /12/ As in Alternatives A and B, as the ratio of residential uses to other uses in the Project Area increases, the proportion of good intent and rescue calls would increase while the proportion of building fires and hazard calls would decrease. Because of the higher proportion of affordable units in the variant, more medical/service calls would be expected.

- /13/ Compared to Alternative A, more domestic violence and residential burglary incidents and fewer commercial burglaries and thefts would be expected due to the greater proportion of residential uses and no office development. Compared to Alternative B, there would be fewer domestic violence and residential burglary incidents but more commercial burglaries and thefts.

- /14/ Use of a standard to estimate open space demand has several shortcomings. Standards address quantity, but not type and quality of open space or how well it is designed, meets community needs, or reflects current leisure needs and preferences. Standards do not account for socioeconomic changes in a community over time and may or may not be realistic in light of a community's ability to implement them.

- /15/ VI.E. Transportation contains an extensive discussion of travel demand forecasting for the Project Area, Downtown & Vicinity, and the rest of the region, and the effects of this projected travel demand on operating conditions at screenlines (highways and transit), local intersections and on MUNI routes serving the Project Area. For highways at the regional screenlines, at build-out (see Table VI.E.14, pp. VI.E.106-VI.E.107, and Table VI.E.15, pp. VI.E.108-VI.E.109), small numerical differences in outbound traffic during the p.m. peak period and hour among Alternatives A, B and N do not produce significantly different impacts in terms of the duration of congestion. For transit systems (see Table VI.E.16, pp. VI.E.115-VI.E.116; Table VI.E.117, pp. VI.E.117-VI.E.118; Table VI.E.18, pp. VI.E.119-VI.E.120; and Table VI.E.19, pp. VI.E.121-VI.E.122), cumulative transit ridership at screenlines is forecast not to be different among Alternatives A, B, and N, except for the South Bay screenline. A significantly higher CalTrain ridership under Alternative N than under Alternatives A or B could be caused by the relocation of the San Francisco CalTrain terminus further from the downtown employment center with the latter Alternatives. As shown in Table VI.E.20

(p. VI.E.130), however, there would be no significant differences in cumulative outbound transit levels of service during the p.m. peak period and hour among the Alternatives. For local intersections (pp. VI.E.166-VI.E.175), very few differences exist among Alternatives A, B, and N for 2020 Levels of Service (Table VI.E.26, pp. VI.E.167-VI.E.168), and these few differences are too small to be considered significant. For MUNI routes serving the Project Area, 2020 Levels of Service (Table VI.E.27, p. VI.E.177) with Alternative B would be worse than with Alternatives A or N, as the larger number of residents in Alternative B would generate more southbound (peak direction) p.m. peak-period trips than would the other Alternatives. The numerical differences in travel demand among Alternatives A, B, and N are greater than those between Alternative B and this variant.

• /16/ On-street parking space availability for Project Area demand in all Alternatives and variants assumes spaces on residential streets, beyond 1,500 feet from non-residential uses, on Project Area boundary streets, or on streets with traffic flow parking restrictions such as King and Third Streets, are not available for commercial parking demand.

• /17/ Vehicle trips generated by the variant would be about 9% lower than vehicle trips generated by the Project Area under Alternative B; however, some commute trips could be longer than those under Alternative B, due to less Project Area housing and thus fewer opportunities for downtown employees to live in the Downtown & Vicinity as compared to Alternative B.

• /18/ Williams, P.B., "An Overview of the Impact of Accelerated Sea Level Rise on San Francisco Bay," Philip Williams and Associates, Project #256, San Francisco, California, 1985.

• /19/ Peggy Kohl, Endangered Species Office, U.S. Fish and Wildlife Service, Sacramento, California, telephone conversation, March 1989.

• /20/ Gary Page, Director of Ocean and Estuarine Research, Point Reyes Bird Observatory, Stinson Beach, California, telephone conversation, March 1989.

• /21/ San Francisco Department of City Planning, "Wetland Habitat Creation at Mission Bay Project Site between Piers 48 and 50: A Special Study for Mission Bay," prepared by Wetlands Research Associates, September 1986, portion of Special Study for Mission Bay.

• /22/ Dry excavation of the site of the future wetland which takes place behind a barrier capable of excluding all water from the site. Sheet piles are often used for this purpose. Some water may be present in the spaces in the rubble which makes up the site substrate.

• /23/ Roberts, B. and B. Hecht, "Initial Hydraulic Assessment: Mission Bay," prepared for ESA by Balance Hyrologics, Inc., Berkeley, California, 1989.

• /24/ Variant 8, pp. VII.47-VII.57, also contains information on variation in the percentage of affordable housing and the size of affordable units.

• /25/ For comparison, the range of prices and rents for affordable housing in Alternatives A and B would include prices and rents affordable to middle-income households, and households in the higher ranges of the moderate-income category. In those Alternatives, there would be no housing affordable to low-income households or to households in the lower ranges of the moderate-income category.

- /26/ An amendment to the MTC/BCDC Seaport Plan, approved March 16, 1989, would permit deletion of the designation of Piers 52–64 as a Near-Term marine terminal site for container development if:

    1) All of the former Western Pacific property at Warm Water Cove is transferred from Santa Fe Pacific Realty Corporation to the Port (see p. V.42 regarding this land exchange), and

    2) The Port and City develop a strategy to ensure Port-Priority Use Areas are reserved for port purposes, and non-port-owned areas needed for marine terminal uses at Piers 70 to 80 are available.

    (See also Volume Four, XV.A. Public Plans, Policies and Permits, pp. XV.A.1–XV.A.5 for additional information on the Seaport Plan amendment.)

- /27/ Employment in the Project Area would range from 24,100 to 25,100 jobs depending on the types of businesses located in the S/LI/RD/O space. For purposes of the EIR analysis, the high end of the range is used, assuming S/LI/RD/O space would be occupied by office activities. With S/LI/RD space only, there would be fewer employees accommodated, since those activities typically utilize more building space per worker than office activities.

- /28/ H&H Ship Services would be considered a hazardous waste property under the State Hazardous Waste Control Law. Land uses adjacent to such properties are not limited by state or federal law. For additional discussion of the State Hazardous Waste Control Law, see p. VI.N.4 and pp. 16–17 of the Hazards Mitigation Program.

- /29/ The distribution of the market-rate housing according to number of bedrooms could vary, resulting in estimates of Project Area population ranging from 14,700 to 16,400 residents. The higher population estimate is assumed for the EIR analysis. Population at the lower end of the range would be very similar to that estimated for Alternative A (14,400). The higher population estimate would fall between the amounts estimated for Alternatives A (14,400) and B (18,700).

- /30/ For purposes of EIR analysis, these estimates assume that the land designated as S/LI/RD/O would be developed for office uses. If this land were developed for S/LI/RD uses rather than for office use, the OAHPP requirement for office development under the variant would be lower, requiring payment of an in-lieu fee of $33.31 million or construction of 1,853 housing units, 1,149 to be affordable to households of moderate or lower income.

- /30a/ Under the revised OAHPP affordability requirements adopted in 1990, the City's OAHPP would require that 1,364 affordable units be produced for office development under the variant, and that those units be ownership units at purchase prices that, on average, are affordable to households of median income and/or rental units at rents that, on average, are affordable to households at 60% of median income. For analysis, the 3,000 affordable housing units in the Project Area under the variant are assumed to be priced to be affordable to households with incomes ranging from 50% to 120% of median household income. Given this range of prices, it is likely that the OAHPP affordability requirements would be met if Project Area affordable housing was ownership housing (where the OAHPP requirement is for units that, on average, are affordable to households of median income) or a mix of owned and rental housing (where the OAHPP requirement is for units that, on average, are affordable to households at about 80% of median income). The OAHPP requirements probably would not be met if Project Area affordable housing was only rental (where the OAHPP requirement is for units that, on average, are affordable to households at 60% of median income).

- /31/ The estimate of additional housing units to accommodate San Francisco households with Project Area workers was developed using the approach followed in analyzing the jobs/housing relationship for Alternatives A, B, and N. The approach is described on pp. VI.C.68–VI.C.70, and background is provided in Volume Three, Appendix C, pp. XIV.C.29–XIV.C.37. Values in the calculations that reflect the cumulative context were estimated for the variant based on the work done for Alternatives A, B, and N. Background on the calculations is provided in working papers available for review at the Department of City Planning, 450 McAllister Street.

- /32/ The number of affordable housing units for the additional San Francisco households with Project Area workers was estimated by comparing the estimated distribution of San Francisco households with Project Area workers among household income categories to the price range for affordable housing in Mission Bay under the variant.

- The following is included for informational purposes in light of public concern regarding the affordability of housing in this particular variant.

BACKGROUND FOR CONSIDERATION OF ABILITY OF SAN FRANCISCO HOUSEHOLDS WITH PROJECT AREA WORKERS TO AFFORD HOUSING IN MISSION BAY UNDER VARIANT 12, DEVELOPMENT AGREEMENT APPLICATION •

Household Incomes as Percent of Median Income /a/	Estimated Distribution of San Francisco Households with Project Area Workers	By Income Category, Estimated Number of Housing Units for Additional San Francisco Households with Project Area Workers
Less than 50%	17.3%	626
50% - 80%	26.8%	970
80% - 120%	17.85%	647
120% - 165%	17.85%	646
More than 165%	20.2%	731
TOTAL	100.0%	3,620

NOTE: If affordable housing under the variant is assumed to be priced to be affordable to households with incomes ranging from 50% to 120% of median household income, the above indicates that additional San Francisco households with Project Area workers could require 1,617 (970 + 647) or about 1,620 units of housing in that price range.

/a/ See Table XIV.C.18 on p. XIV.C.37 in Volume Three.

SOURCE: Recht Hausrath & Associates

- /33/ As in Alternatives A and B, as the ratio of residential uses to other uses in the Project Area increases, the proportion of good intent and rescue calls would increase while the proportion of building fires and hazard calls would decrease. Because of the higher proportion of affordable units in the variant, more medical/service calls would be expected.

- /34/ Compared to Alternative A, there would be more residential burglary incidents and fewer commercial burglaries and thefts. Compared to Alternative B, there would be fewer domestic violence and residential burglary incidents but more commercial burglaries and thefts.

- /35/ Use of a standard to estimate open space demand has several shortcomings. Standards address quantity, but not type and quality of open space or how well it is designed, meets community needs, or reflects current leisure needs and preferences. Standards do not account for socioeconomic changes in a community over time and may or may not be realistic in light of a community's ability to implement them.

- /36/ VI.E. Transportation contains an extensive discussion of travel demand forecasting for the Project Area, Downtown & Vicinity, and the rest of the region, and the effects of this projected travel demand on operating conditions at screenlines (highways and transit), local intersections, and on MUNI routes serving the Project Area. For highways at the regional screenlines, at build-out (see Table VI.E.14, pp. VI.E.106-VI.E.107, and Table VI.E.15, pp. VI.E.108-VI.E.109), small numerical differences in outbound traffic during the p.m. peak period and hour among Alternatives A, B, and N do not produce significantly different impacts in terms of the duration of congestion. For transit systems (see Table VI.E.16, pp. VI.E.115-VI.E.116; Table VI.E.17, pp. VI.E.117-VI.E.118; Table VI.E.18, pp. VI.E.119-VI.E.120; and Table VI.E.19, pp. VI.E.121-VI.E.122), cumulative transit ridership at screenlines is forecast not to be different among Alternatives A, B, and N, except for the South Bay screenline. A significantly higher CalTrain ridership under Alternative N than under Alternatives A or B could be caused by the relocation of the San Francisco CalTrain terminus further from the downtown employment center with the latter Alternatives. As shown in Table VI.E.20 (p. VI.E.130), however, there would be no significant differences in cumulative outbound transit levels of service during the p.m. peak period and hour among the Alternatives. For local intersections (pp. VI.E.166-VI.E.175), very few differences exist among Alternatives A, B, and N for 2020 Levels of Service (Table VI.E.26, pp. VI.E.167-VI.E.168), and these few differences are too small to be considered significant. For MUNI routes serving the Project Area, 2020 Levels of Service (Table VI.E.27, p. VI.E.177) with Alternative B would be worse than with Alternatives A or N, as the larger number of residents in Alternative B would generate more southbound (peak direction) p.m. peak-period trips than would the other Alternatives. The numerical differences in travel demand among Alternatives A, B, and N are greater than those between Alternative A and this variant.

- /37/ On-street parking space availability assumes that spaces on residential streets, beyond 1,500 feet from non-residential uses, on Project Area boundary streets, or on streets with traffic flow parking restrictions such as King and Third Streets, are not available for commercial parking demand.

- /38/ Vehicle trips generated by the variant would be about 1% higher than vehicle trips generated under Alternative A; however, some commute trips could be shorter than those under Alternative A, due to an increase in housing and thus more opportunities for downtown employees to live in the Downtown & Vicinity as compared to those under Alternative A.

VIII. SIGNIFICANT ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IF THE PROPOSED PROJECT IS IMPLEMENTED

This chapter lists those significant impacts that would result from approval of one of the Alternatives or a variant of the Alternatives and that could not be mitigated by changes or additions to the project. This EIR cannot list with specificity the impacts that would result from approval of a particular Alternative or variant because it is too early in the process to predict whether any of the available mitigation measures would be included in a development project either by the project sponsor, Santa Fe Pacific, or by the City. A listing of the specific impacts that are not mitigated will be part of the decision making documents.

The significant impacts that follow are those for which mitigation measures are either not available or would not mitigate to a level of insignificance. Thus, for example, Alternative A could cause significant effects on Pacific herring populations if dredging in the Channel were to occur during the spawning season as described on p. VI.M.14. However, that impact is not listed below because a mitigation measure prohibiting dredging or dredge disposal during the spawning season in any of the spawning areas is available (see p. 25) that would reduce the impact to acceptable levels.

Alternative	Effect
A,B	Alternatives A and B would change the principal types of land uses in the Project Area. Housing, office, and retail uses would replace existing railroad, industrial, warehousing, and transportation uses and vacant land.
• A,B	Housing and other non-maritime uses east of Third Street under Alternatives A and B would preclude development of a major container terminal on piers adjacent to the Project Area, and would result in insufficient backland area for new marine terminal facilities.
•	In March 1989, the Bay Conservation and Development Commission (BCDC) approved an amendment to the Seaport Plan. Subject to certain conditions, the amendment allows Piers 52 to 64 to be deleted as a designated Near-Term marine terminal site, and newly designates an area between Piers 70 and 80 as a Near-Term site. The conditions of this amendment require that 1) ownership of

Alternative — Effect

former Western Pacific property at Warm Water Cove (between Piers 70 and 80) is transferred from Santa Fe Pacific Realty Corporation to the Port of San Francisco; and 2) the Port and City develop a strategy, for approval by BCDC, that assures that port-priority areas in the Pier 70-80 area are reserved for Port purposes, and that non-port-owned land needed for marine terminal use in that area is available to the Port.

Until those conditions are satisfied, the Seaport Plan amendment retains the designation of Piers 52 to 64 as a Near-Term marine terminal site and the area east of Third Street as a port-priority area. Therefore, the possibility for Mission Bay development under Alternatives A and B to preclude container terminal opportunities in San Francisco, adjacent to the Project Area, is included as a potential unavoidable significant impact.

A,B,N

Increased housing under Alternatives A and B and employment under all Alternatives would result in increased use of all transportation systems. Mitigation measures are available that would reduce some otherwise significant transportation effects. However, all Alternatives would contribute to unavoidable significant cumulative traffic impacts in 2000 and 2020 that would result in expanded congestion on the regional freeway system. Most of the increases in regional cumulative traffic would come from regional origins and destinations (that is, trips neither originating nor ending in the Downtown & Vicinity, including Mission Bay). Mitigation measures for long-range future reduction in freeway and transit congestion are discussed at two levels:

- increases in service capacity on the existing transportation network (for 2000); and
- identification of the types of infrastructure improvements on the regional transportation system that would accommodate the majority of San Francisco travel demand (for 2020).

Although those mitigation measure are identified, contribution of the Mission Bay Alternatives to expanded cumulative traffic congestion is included as an unavoidable significant effect. That is

Alternative	Effect
	because many of those measures would require regional, state, and federal-level approvals, and implementation over a long period that exceeds the planning horizons addressed in most regional transportation planning. In response to projected highway congestion, Downtown & Vicinity trips (including Project Area trips) are assumed in the analysis in this EIR to shift from single-occupant autos to ridesharing and transit in percentages well beyond the existing modal shares of the latter two modes. The shifts to transit would place a major burden on regional systems. Additions from the Project Area (and Downtown & Vicinity) to cumulative traffic increases on local streets would be mitigated by planned and suggested improvements to intersections and nearby freeway ramps. However, those improvements also would add traffic to intersections in and near the Project Area, and not all intersection and freeway ramps could be improved to acceptable levels of service. Thus, cumulative travel from the Project Area and Downtown & Vicinity would contribute to unacceptable levels of service at some intersections.
A,B,N	The additional development projected to occur with all Alternatives would result in increased travel to and from San Francisco, contributing to cumulative vehicle emissions within the Air Basin. Those emissions would incrementally increase the frequency of violations of air quality standards for particulate matter (PM_{10}) and for ozone during periods of poor ventilation, with concomitant health effects and reduced visibility. Emissions of air pollutants from Project Area travel would also exceed 1% of countywide emissions. The 1% level is a threshold used by BAAQMD to identify "significant" increases in air emissions. For all Alternatives, carbon monoxide, hydrocarbon and nitrogen oxide emissions would exceed the 1% threshold.
A,B,N	All Alternatives would have a significant seismic safety impact, as they would accommodate a higher residential and / or employment population that would be subject to substantial danger during

Alternative	Effect
	a major earthquake. If stringent building standards are adopted for new construction, as described in VI.K. Geology and Seismicity: Mitigation, measures K.9–K.11, pp. VI.K.47–VI.K.48, the Alternatives would be as safe or safer than other areas in San Francisco, thereby reducing risk. However, greater concentrations of people would be susceptible to injury and would create congestion, which, along with debris in the streets, would impede the access of emergency vehicles responding to fire and other earthquake-related emergencies. Implications of this seismic impact are described in VI.K. Geology and Seismicity, p. VI.K.33.
A	Dredging in China Basin Channel and disposal of the material at either an ocean or Bay (likely to be Alcatraz) disposal site could cause unavoidable potentially significant impacts in the channel and at the disposal site. Based on data presently available on the levels of contaminants in channel sediments, dredging of spoils would release contaminants into the water column in the channel and at the disposal site. Although contaminant concentrations would be reduced after initial mixing, it is not possible to determine whether water quality objectives and criteria would be met because of a lack of more recent chemistry and toxicity data on channel sediments. Thus, if the sediments contained contaminants that violated public health standards or ecological effects thresholds, dredging would cause temporary but unavoidable significant effects on water quality and biologic resources in the channel.
	Within one year before filing dredging permit applications with the U.S. Army Corps of Engineers, detailed tests would be required to determine the nature and reactivity of channel sediments. If it is determined that the sediments violate standards or thresholds for contaminants, Bay or ocean disposal would be prohibited; land disposal would instead be required as a condition to issuing permits, thus avoiding water quality impacts in the Bay or ocean. Results would be disclosed in public notices of the applications, and there would be an opportunity for a public hearing before issuance of final permits for any dredging and disposal.

IX. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Alternative	Relationship
• A,B	Approval of these or similar Alternatives would change and intensify land uses in the Project Area. Approval of these land use changes in the near future would preclude other uses that later might be found desirable. In particular, housing and other non-maritime uses east of Third Street under Alternatives A and B would preclude development of a container terminal on the piers adjacent to the Project Area and could interfere with long-term productive use of the Bay unless the exchange of a Near-Term site designation between Piers 52-64 and the area between Piers 70 and 80, as described in the March 1989 Seaport Plan amendment, were approved by BCDC. Such approval, provided a land exchange also took place and other required conditions were met, would provide a suitable substitute to meet regional container-handling needs. (For more detail on the Seaport Plan amendment, see the discussion in VI.A. Public Plans, Policies and Permits, beginning on p. VI.A.19.)
N	Retention of existing zoning districts and Master Plan provisions covering the Project Area, as in Alternative N, would permit later choices for other uses in the near term. If existing controls were retained for a long period, development as described for this Alternative would probably preclude major changes in use as contained in Alternatives A or B.
B	Construction of wetlands would preclude other uses such as residential, commercial or port-related maritime uses in the long term, unless the flooded areas were refilled and the wildlife habitats were returned to urban, developed land.

Alternative	Relationship
A,B,N	All Alternatives would include treatment or removal and disposal of hazardous materials that may be present in the Project Area from previous industrial and commercial uses, in compliance with applicable local and state regulations. This would enhance the long-term environmental safety of the Project Area. Alternatives A and B, as master-planned Alternatives, would implement a comprehensive Mitigation Plan for cleanup of hazardous materials; cleanup under Alternative N would be likely to proceed on an incremental site-by-site basis as developments are proposed.

X. SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

Alternative	Change
A,B,N	All Alternatives would commit the Project Area to more-intense urban uses, compared to existing vacant railroad, industrial, warehousing, and transportation uses, and vacant land.
• A,B	Alternatives A and B would preclude long-term development of container terminal uses east of Third Street and on piers adjacent to the Project Area. Alternatives A and B would not provide sufficient backland area for new terminal facilities. While capital improvements to improve existing container-handling facilities at Piers 80 to 96 are planned, those improvements would not replace entirely container-handling capacity adjacent to the Project Area that would be lost. However, if the exchange of a Near-Term designation between Piers 52 and 64 (adjacent to the Project Area) and an area between Piers 70 and 80, as described in the March 1989 Seaport Plan amendment, were approved by BCDC, container-handling facilities could be located near Piers 70 and 80. In that case, Mission Bay development would not reduce container cargo capacity in San Francisco (or the Bay Area region). (For more information regarding the 1989 Seaport Plan amendment, see the discussion in VI.A. Public Plans, Policies and Permits, beginning on p. VI.A.19.)
A,B,N	Construction materials and energy used for all Alternatives would involve use of some nonrenewable resources. Continued development would also result in continuing increases in automobile and transit trips. The additional trips, plus construction activities from new development, would contribute to future cumulative air quality impacts from increases in particulate matter, CO and ozone precursor emissions.

Alternative	Change
A,B,N	All Alternatives would be in an area subject to substantial seismic hazard, similar to other areas of the City underlain by fill. Development of more businesses and residences in the area would increase the employee and resident population, resulting in exposure of larger numbers of people to death and injury in the event of a major earthquake in the Bay Area. If the stringent building standards of the 1988 Uniform Building Code were adopted for new construction, the Alternatives would be as safe as or safer than other areas in San Francisco.

XI. REPORT AUTHORS AND PERSONS CONSULTED

REPORT AUTHORS

EIR AUTHORS

San Francisco Department of City Planning
450 McAllister Street, 4th Floor
San Francisco, CA 94102
Barbara W. Sahm, Environmental Review Officer
Diane Oshima, Mission Bay EIR Coordinator

PROJECT SPONSOR AND PROJECT CONSULTANTS

Catellus Development Corporation
(formerly Santa Fe Pacific Realty Corporation)
201 Mission Street, Suite 202
San Francisco, CA 94105
James W. Augustino
Kerstin Fraser Magary
P.D. Marini
Prem Chaudhri

Coblentz, Cahen, McCabe & Breyer
222 Kearny Street
San Francisco, CA 94108
Pamela S. Duffy, Esq.
Susan J. Passovoy, Esq.

DKS Associates
1956 Webster Street, Suite 300
Oakland, CA 94612
Daniel T. Smith, Principal

Dames & Moore
221 Main Street, Suite 600
San Francisco, CA 94105
Robert Darragh

The Jefferson Company
1700 California Street, Suite 470
San Francisco, CA 94109
James Jefferson
Avonee Smith

PROJECT SPONSOR AND PROJECT CONSULTANTS (Cont.)

KCA Engineers
318 Brannan Street
San Francisco, CA 94103
Robert W. Barton, President

Nossman, Guthner, Knox & Elliot
100 The Embarcadero, Third Floor
San Francisco, CA 94105-1295
Michael Wilmar, Esq.

Ticor Title Insurance
Underwriting Practices
160 Pine Street
San Francisco, CA 94111
Mary Pat Noeker, Administrative Assistant

EIR CONSULTANTS

Environmental Science Associates, Inc.
ESA/Planning and Environmental Services
(Prime Consultant)
301 Brannan Street, Suite 200
San Francisco, CA 94107
Richard Cole, Ph.D.: Associate-in-Charge
Nancy Cunningham Clark: EIR Project Manager
James C. Banks, Diane Scholz, Keith Kjelstrom: Assistant Project Managers
Bruce Campbell: Task Leader (Energy, Noise, Air Quality, Hazardous Materials)
  James C. Banks
  Kristian Macoskey
  Jefferson Wehling
  Max G. Rodel
Michael Rice: Task Leader (Public Plans, Policies and Permits, Community Services and Infrastructure, Cultural Resources, Architectural Resources and Urban Design)
  Glen E. Elder, Ph.D. Candidate
  Charles B. Bennett

EIR CONSULTANTS (Cont.)

Environmental Science Associates, Inc. (Cont'd)

Mark F. Winsor, Ph.D.: Task Leader (Geology and Seismicity, Hydrology and Water Quality, Vegetation and Wildlife)
Sandra Guldman
Gary W. Oates
Sandia Potter
Gregg B. Miller
Katherine Cuneo, Ph.D.
James C. Banks: Task Leader (Highlights & Conclusions)
Lisa Bautista, Cheryl Fowler, Georgette Simmonds: Lead Word Processors
S. Elizabeth Haines: Editor
Robert Suhr, Valerie Reichert, Lisa Crossett: Lead Graphic Artists

Barton-Aschman Associates
(Transportation)
100 Park Center Plaza, Suite 450
San Jose, CA 95113
Norman Steinman
Frederick C. Dock
David Fairchild
Robert Eckols

Baseline Environmental Consulting
(Air Quality)
315 Washington Street
Oakland, CA 94607
Irene Kan

Roger Owen Boyer and Associates
(Architectural Resources and Urban Design)
1009 MacDonald Avenue, Suite 3
Richmond, CA 94801
Roger Owen Boyer

David Chavez & Associates
(Cultural and Historic Resources)
P.O. Box 52
Mill Valley, CA 94941
David Chavez

Geotechnical Consultants, Inc.
111 New Montgomery Street
San Francisco, CA 94105
Joseph Gonzalez
Susan Wickham

EIR CONSULTANTS (Cont.)

Professor Scott Lynn, Ph.D.
Department of Chemical Engineering
University of California Berkeley
201 Gilman Hall
Berkeley, CA 94720

Recht Hausrath & Associates
(Land Use, Business Activity and Employment, Housing and Population, Growth Inducement)
1212 Broadway, Suite 1700
Oakland, CA 94612
Linda Hausrath
Sally Nielsen
Mary Catherine Haug-Boone

E.M. Rose & Associates
(Libraries and Solid Waste)
435 Bryant Street
San Francisco, CA 94107
Edward M. Rose

PERSONS CONSULTED

CITY AND COUNTY OF SAN FRANCISCO

City Attorney's Office
214 Van Ness Avenue
San Francisco, CA 94102
Noreen M. Ambrose, Deputy City Attorney
Christine Desser, Deputy City Attorney

Clean Water Program
770 Golden Gate Avenue
San Francisco, CA 94102
Daniel M. Champeau, Project Manager
J.M. DelaCruz, Division Chief
David Jones
Thomas Landers
Don Munakata, Project Manager
Arleen Navarret, Water Quality Chemist

Hetch Hetchy Water and Power Department
693 Vermont Street
San Francisco, CA 94107
Lawrence Kline, Deputy General Manager

CITY AND COUNTY OF SAN FRANCISCO (Cont'd)

Office of the Chief Administrative Officer

City Hall
San Francisco, CA 94102
Rudolph Nothenburg, Chief Administrative Officer
Amy Perlmutter, Recycling Coordinator

Office of the Mayor

City Hall
San Francisco, CA 94102
Steven LaPlante, Special Coordinator for the Homeless

Port of San Francisco

Ferry Building
San Francisco, CA 94111
Louise Anderson, Traffic Analyst
Cliff Jarrard, Chief Harbor Engineer
John Kellogg, Trade Development Manager
Philip Kern, Project Manager
Randall Rossi, Director of Planning
Henry Williams, Assistant Commercial Property Manager
Richard Wiederhorn, Planning Manager
Kerri Lung, Developmental Project Manager

San Francisco Department of City Planning

450 McAllister Street
San Francisco, CA 94102
Dean L. Macris, Director of Planning
George A. Williams, Assistant Director, Plans and Programs
Robert W. Passmore, Assistant Director, Implementation
Alec S. Bash, Mission Bay Project Director
Rana Ahmadi
Eugene Coleman, Mission Bay Community Coordinator
Lilia Medina, Mission Bay Planner
Amit Ghosh
Peter Groat
Richard Hedman
Roger Herrera
Jonathan Hussey
Rebecca Kohlstrand
Peter LaBrie, Jr.

CITY AND COUNTY OF SAN FRANCISCO (Cont'd)

San Francisco Department of City Planning (Cont'd)

Andrea McKenzie
Jonathan Malone
Sally Maxwell
Susana Montana
Lois Scott
Chi Hsin Shao
Steven Shotland

San Francisco Department of Public Health

101 Grove Street
San Francisco, CA 94102
Donna D'Acuti, Emergency Medical Services Coordinator
Charles B. Darke, Dental Director
James T. Gilday, Health Program Planner
William L. Lee, Manager, Toxic Control
Aubrey Lewis, Senior Rodent Control Inspector
Les Lum, Senior Environmental Health Inspector
William McConnell, Director of Planning and Evaluation, Community Mental Health Services
Teresa Serata, Health Program Planner
Cynthia Woo, Fire Inspector

San Francisco Department of Public Works

460 McAllister Street
San Francisco, CA 94102
Patrick Petersen, Station Engineer
Division of Streets and Highways
V. H. Tronan, Director
Joe Cheung
Tim A. Molinare, Division Engineer
Gordon M. Wong, Division Engineer
Bureau of Street and Sewer Repair
David Conci, Superintendent of Bridges and Tunnels
Bureau of Water Pollution Control
Jerry O'Brien, Project Manager
Steve Medberry
Special Projects Division
Franklin Lew, Manager
Office of the Chief Administrative Officer
Margaret Divine, Project Manager

CITY AND COUNTY OF SAN FRANCISCO (Cont'd)

San Francisco Fire Department
260 Golden Gate Avenue
San Francisco, CA 94102
Frank Blackburn, Assistant Chief
Gerald Cullen, Deputy Chief
James McDonagh, Fireman
Howard Slater, Assistant Chief
Oliver Storti, Assistant Chief
James Lynch, Assistant Chief

San Francisco Mayor's Office of Emergency Services
1111 Market Street, Second Floor
San Francisco, CA 94103
Thomas Jenkins, Acting Director

San Francisco Municipal Railway
949 Presidio Avenue
San Francisco, CA
Peter Straus, Director of Service Planning
Luther Freeman, MUNI Strategic Planning

San Francisco Police Department
Planning and Research Division
850 Bryant Street
San Francisco, CA 94103
Thomas W. Suttmeier, Commanding Officer
Thomas Del Torre, Sergeant
Heather J. Fong, Officer
Harold Waterman, Senior Management Assistant
Steven Lutes, Planner

San Francisco Public Library
Civic Center
San Francisco, CA 94102
John Frantz, Librarian (former)
Gladys Hansen, Librarian
Karen Scannell, Chief of Branches

San Francisco Public Utilities Commission
City Hall, Room 287
San Francisco, CA 94102
Lee Knight, Planning and Development Division
Douglas Wright
John Deakin

CITY AND COUNTY OF SAN FRANCISCO (Cont'd)

San Francisco Real Estate Department
25 Van Ness Avenue, Suite 400
San Francisco, CA 94102
Anthony DeLucci, Director
Robert M. Lavell, Senior Right-of-Way Agent
Matthew D. Ashe, Acting Assistant Director of Property
Wallace Wortman, Director of Property

San Francisco Recreation and Park Department
McLaren Lodge, Golden Gate Park
San Francisco, CA 94117
Deborah Learner, Planner
Marilyn Duffey, Consultant
Ronald deLeon, Assistant Supervisor

San Francisco Redevelopment Agency
P.O. Box 646
San Francisco, CA 94101
Thomas G. Conrad, Director, Planning and Programming
Frank Cannizzaro, Project Director, Rincon Point/South Beach

San Francisco Unified School District
801 Toland Street
San Francisco, CA 94124
Lawrence Jacobson, Property Manager

San Francisco Water Department
1990 Newcomb Avenue
San Francisco, CA 94124
James D. Cooney, General Manager
Thomas Dickerman, Chief Division Engineer
Martin H. Lieberman, Manager, City Distribution
Robert Vasconcellos, Resources and Planning Manager

CITY CONSULTANTS

EDAW, Inc.
1725 Montgomery Street
San Francisco, CA 94111
N. Teresa Rea

CITY CONSULTANTS (Cont'd)

Gabriel-Roche, Inc.
10933 Cotter Street
Oakland, CA 94605
Janet Gabriel-Roche
Michael Fajans

Robert L. Harrison
2370 Vista Del Mar Lane
Tiburon, CA 94920

Charles M. Salter Associates, Inc.
930 Montgomery Street
San Francisco, CA 94133
Richard Illingsworth

Shute, Mihaly & Weinberger
396 Hayes Street, Suite 1
San Francisco, CA 94102
Marc Mihaly, Esq.
Terry Watt

Philip Williams and Associates
Pier 33 North, The Embarcadero
San Francisco, CA 94111
Philip Williams, Principal

REGIONAL AGENCIES

Association of Bay Area Governments
P.O. Box 2050
Oakland, CA 94604
Raymond Brady, Manager, Analysis Group
Susan Hootkins, Senior Regional Planner

BART
1221 Broadway, Suite 1800
Oakland, CA 94612
Martin Birkenthal, SRTP Planner

Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109
Richard Duker, Meteorologist
Dario Levaggi
Tirlochan Mangat, Manager
Irwin Mussen
Thomas E. Perardi, Manager
James S. Sandberg, Meteorologist
Jean Roggenkamp
Bill DeBoisblanc, Manager, New Source Review

REGIONAL AGENCIES (Cont'd)

Bay Conservation and Development Commission
30 Van Ness Avenue
San Francisco, CA 94102
Jeff Blanchfield, Director
Stephen McAdam, Assistant Director
Robert Batha, Environmental Planner
Joan L. Lundstrom, Permit Analyst
Diane Penny, Permit Analyst

Golden Gate Bridge, Highway and Transportation District
1011 Enderson Drive
San Rafael, CA 94901
Jerome M. Kuykendall, Director of Planning

Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94604
Jeff Georgevich
Marc Rodin
Susan Hardy

San Francisco Regional Water Quality Control Board
1800 Harrison, Suite 700
Oakland, CA 94612
Stephen Hill, Environmental Specialist
Kenneth J. Theisen, Water Resources Control Engineer

STATE OF CALIFORNIA

Department of Fish and Game
411 Burgess Drive
Menlo Park, CA 94025
Robert Tasto, Fisheries Biologist

P.O. Box 47
Yountville, CA 94599
Brian Hunter, Manager, Region 3

Department of Health Services
714/744 P Street
P.O. Box 942732
Sacramento, CA 94234-7320
David Leu, Chief of Alternative Technology
Robert Feather, Waste Management Engineer, Site Mitigation Division, Toxic Substances Control Division, Region 2

STATE OF CALIFORNIA (Cont'd)

Department of Health Services (Cont'd)
Salvatore Ciriello, Senior Waste Management Engineer, Region 2

Department of Transportation (Caltrans)
150 Oak Street
San Francisco, CA 94102
Linda Bohlinger
Joe Brown, Deputy District Director for Construction
George Gray, Deputy District Director for Planning and Public Transportation
Steven Mikesell
Robert S. Nielsen
Eric Schatmeier
Frank Tedesco, Branch Chief, Project Development

Employment Development Department
P.O. Box 7774
San Francisco, CA 94120
Camille Jordan

Natural Diversity Data Base
1416 9th Street, Room 1225
Sacramento, CA 95814
Rick York, Botany Research Assistant

Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102
Tack Joe
William Well

State Lands Commission
1807 13th Street
Sacramento, CA 95814
Jane Sekelsky

FEDERAL AGENCIES

National Marine Fisheries Service
777 Sonoma Avenue, Room 325
Santa Rosa, CA 95404
James Bybee, Environmental Coordinator

U.S. Army Corps of Engineers
211 Main Street
San Francisco, CA 94105
Dean Smith, Manager of Regulatory Permit Program

FEDERAL AGENCIES (Cont'd)

U.S. Coast Guard
Eleventh District
Bridge Section North
Building 10, Room 214
Coast Guard Island
Alameda, CA 94501
Steven Sandoval, Petty Officer
Rosa Guerra, Assistant Chief
Wayne R. Till, Chief

U.S. Environmental Protection Agency
215 Fremont Street
San Francisco, CA 94105
Frank M. Covington, Director, Water Management

U.S. Fish and Wildlife Service
2800 Cottage Way
Sacramento, CA 95825
Margaret A. Kohl, Fish and Wildlife Biologist

U.S. National Park Service / Golden Gate National Recreation Area
Fort Mason
San Francisco, CA 94123
Thomas McGrath, Project Manager/Historical Architect, Golden Gate National Recreation Area, Maritime Unit

PERSONS AND ORGANIZATIONS

Applied Technology Council
3 Twin Dolphin Drive, Suite 275
Redwood City, CA 94065
Christopher Rojahn, Executive Director

Archeo-Tec, Inc.
955A Stannage Street
Albany, CA 94706
Alan Pastron

Associated General Contractors
1255 Post Street
San Francisco, CA 94109
Thomas Thompson

B.C. Pavilion Corp.
Norman Stowe, Public Relations

PERSONS AND ORGANIZATIONS (Cont'd)

• EQE, Inc.
595 Market Street
San Francisco, CA 94105

• Flack & Kurtz
475 Fifth Avenue
New York, NY 10017
Helen Diemer

The Foundation for San Francisco's Architectural Heritage
2007 Franklin Street
San Francisco, CA 94109
Christopher H. Nelson, Architectural Historian

Golden Gate Disposal Company
900 Seventh Street
San Francisco, CA 94107
Fiore Garbarino, Treasurer

• HOK
323 W. Eighth Street, Suite 700
Kansas City, MO 64105
Randy L. Dvorak

Nancy Olmsted
c/o Mission Creek Conservancy
300 Channel Street, #21
San Francisco, CA 94107

Pacific Gas and Electric Company
77 Beale Street
San Francisco, CA 94104
John C. Brisky
Edward Guerrero, Division Operator Supervisor
William Healy, Gas Plant Foreman
Gerald Tyson, Marketing Supervisor
Richard Van Ulden, Marketing Manager

• Point Reyes Bird Observatory
Stinson Beach, CA
Gary Page, Director of Ocean and Estuarine Research

Potrero Hill Neighborhood House
953 DeHaro
San Francisco, CA 94107
Enola Maxwell, Director

PERSONS AND ORGANIZATIONS (Cont'd)

San Francisco Building and Construction Trades Council
400 Alabama Street
San Francisco, CA 94110
Stanley Smith, Secretary

San Francisco Giants •
Candlestick Park
San Francisco, CA 94124
Marlene Canard, Personnel Administrator

Seismic Investigation and Hazard Survey Advisory Committee
City Hall, Room 266
San Francisco, CA 94102
Joseph Litehiser, Technical Chairman
John Elberling, Citizen Chairman

Southern Pacific Transportation Company
One Market Plaza
San Francisco, CA 94105
Peter Rogers, Trainmaster (Brisbane)
John Grother, General Manager for Passenger Service •

Sunset Scavenger Corporation
Tunnel Avenue & Beatty Road
Brisbane, CA
Louis F. Pitto, General Manager

Bruce White, Ph.D
3207 Shelter Cove
Davis, CA 95616

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Parties below are the government agencies and libraries that received copies of the Mission Bay Final EIR, or notice of availability. The full list of parties receiving notice of the availability of the Final EIR is available for public review at the Department of City Planning, Office of Environmental Review, 450 McAllister Street, Room 401, San Francisco.

CITY AND COUNTY OF SAN FRANCISCO

The Honorable Art Agnos
Office of the Mayor
City Hall
San Francisco, CA 94102

San Francisco City Planning Commission
450 McAllister Street
San Francisco, CA 94102
Attn: Sharon Rogers
Susan J. Bierman
Douglas Engmann
Wayne Jackson Hu
James B. Morales
Edward C. Sewell
Norman Karasick, Alternate
Romaine Baldridge, Alternate

Landmarks Preservation Advisory Board
450 McAllister Street
San Francisco, CA 94102
Attn: Vincent Marsh

Office of the Chief Administrative Officer
City Hall
San Francisco, CA 94102
Attn: Rudolph Nothenberg, Chief Administrative Officer

Office of the Chief Administrative Officer
City Hall
San Francisco, CA 94102
Attn: Amy Perlmutter, Recycling Coordinator

City Attorney's Office
1390 Market Street, 6th Floor
San Francisco, CA 94102
Attn: Noreen M. Ambrose, Deputy City Attorney

CITY AND COUNTY OF SAN FRANCISCO (continued)

City Attorney's Office
1390 Market Street, 6th Floor
San Francisco, CA 94102
Attn: Elaine Warren, Deputy City Attorney

Clean Water Program
1550 Evans Avenue
San Francisco, CA 94102
Attn: Todd Cockburn

San Francisco Department of Public Works
Bureau of Engineering
Division of Streets and Highways
City Hall, Room 359
San Francisco, CA 94102
Attn: Tim A. Molinare

San Francisco Department of Public Works
Traffic Engineering Division
460 McAllister Street
San Francisco, CA 94102
Attn: Gordon Chester

Department of Public Works
Bureau of Water Pollution Control
750 Phelps Street
San Francisco, CA 94124
Attn: Steve Medberry

Department of Public Works
Special Projects Division
City Hall #266
San Francisco, CA 94102
Attn: Franklin Lew, Manager

CITY AND COUNTY OF SAN FRANCISCO (continued)

San Francisco Fire Department
260 Golden Gate Avenue
San Francisco, CA 94102
Attn: Chief James Lynch

San Francisco Municipal Railway
MUNI Planning Division
949 Presidio Avenue, Room 204
San Francisco, CA 94115
Attn: Peter Straus

San Francisco Municipal Railway
949 Presidio Avenue
San Francisco, CA
Attn: Luther Freeman, MUNI Strategic Planning

San Francisco Public Utilities Commission
425 Mason Street, 4th Floor
San Francisco, CA 94102
Attn: Douglas Wright

San Francisco Public Utilities Commission
Bureau of Energy Conservation
110 McAllister Street, Room 402
San Francisco, CA 94102
Attn: John Deakin, Director

Port of San Francisco
Ferry Building
San Francisco, CA 94111
Attn: Richard Wiederhorn, Planning Division

San Francisco Department of Public Health
101 Grove Street, #324
San Francisco, CA 94102
Attn: James T. Gilday, Health Program Planner

San Francisco Department of Public Health
101 Grove Street, #207
San Francisco, CA 94102
Attn: William L. Lee, Manager, Toxic Control

CITY AND COUNTY OF SAN FRANCISCO (continued)

San Francisco Mayor's Office of Emergency Services
1111 Market Street, Second Floor
San Francisco, CA 94103
Attn: Thomas Jenkins, Acting Director

Mayor's Office of Housing and Economic Development
100 Larkin Street
San Francisco, CA 94102
Attn: Barbara Smith

Mayor's Office of Community Development
100 Larkin Street
San Francisco, CA 94102
Attn: Larry DeCarlo

Recreation & Park Department
McLaren Lodge
Golden Gate Park
Fell and Stanyan Streets
San Francisco, CA 94117
Attn: Mary Burns, General Manager

Police Department
Planning Division
Hall of Justice
850 Bryant Street
San Francisco, CA 94103
Attn: Lt. Thomas W. Suttmeier

San Francisco Unified School District
801 Toland Street
San Francisco, CA 94124
Attn: Lawrence Jacobson, Property Manager

San Francisco Real Estate Department
25 Van Ness Avenue, Suite 400
San Francisco, CA 94102
Attn: Anthony DeLucci, Director

San Francisco Water Department
1990 Newcomb Avenue
San Francisco, CA 94124
Attn: James D. Cooney, General Manager

CITY AND COUNTY OF SAN FRANCISCO (continued)

San Francisco Redevelopment Agency
939 Ellis Street
San Francisco, CA 94102
Attn: Thomas G. Conrad, Director, Planning and Programming

FEDERAL AND STATE AGENCIES

U.S. Army Corps of Engineers
211 Main Street
San Francisco, CA 94105
Attn: Skid Hall, Chief Permits Section

State Office of Intergovernmental Management (10)
State Clearinghouse
1400 - Tenth Street
Sacramento, CA 95814
• Attn: Loreen McMahon

California Department of Transportation
Transportation Planning
P.O. Box 7310
San Francisco, CA 94120
• Attn: Wade Green

California Department of Transportation
Public Transportation Branch
P.O. Box 7310
San Francisco, CA 94120
Attn: Eric Schatmeier

• California State Department of Health Services
2151 Berkeley Way
Berkeley, CA 94704
Attn: Susan Solarz

REGIONAL AGENCIES

Bay Conservation and Development Commission
30 Van Ness Avenue
San Francisco, CA 94102
Attn: Jeff Blanchfield, Director

Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94604
Attn: Jeff Georgevich

REGIONAL AGENCIES (continued)

Association of Bay Area Governments
P.O. Box 2050
Oakland, CA 94604
Attn: Raymond Brady, Manager, Analysis Group

Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109
Attn: Irwin Mussen

San Francisco Regional Water Quality Control Board
1111 Jackson Street
Oakland, CA 94607
Attn: Stephen Hill, Environmental Specialist

Golden Gate Bridge, Highway and Transportation District
1011 Enderson Drive
San Rafael, CA 94901
Attn: Jerome M. Kuykendall, Director of Planning

AC Transit
Research and Planning
508 - 16th Street
Oakland, CA 94612
Attn: Theordore H. Reynolds, Assistant Manager

BART
Planning, Budget and Research
800 Madison Street
Oakland, CA 94604-2688
Attn: Howard L. Goode, Department Manager

SamTrans
Planning/Engineering
945 California Drive
Burlingame, CA 94010
Attn: Director

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San Francisco State University
1630 Holloway Avenue
San Francisco, CA 94132

Institute of Government Studies
109 Moses Hall
University of California
Berkeley, CA 94720

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